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MIDRANGE SYSTEMS SERVICE ANALYSIS

INPUT®

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Customer Service Program (CSP)

Midrange Systems Service Analysis

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Abstract

This report analyzes the service requirements of users of the following midrange system products: AT&T 3B; Concurrent Computer Corporation 32XX; Data General MV series; DEC VAX 8XXX; HP 3000; IBM 937X; IBM AS/400; Prime 9X5X; Tandem Nonstop, TXP, and VLX; and Wang VS. Each individual user group is analyzed separately, and the total sample is analyzed as a group to provide an industry standard.

Each analysis begins with an examination of the contracted service coverage. Next, each analysis measures product reliability and vendors' abilities to optimize system availability through response time and repair time. The criticality of system availability warrants the in-depth analysis of response and repair time which is provided. Then, each analysis examines the user requirement for and satisfaction with traditional elements of hardware maintenance, software support, and ancillary services. In each section, user satisfaction is tested in service areas such as engineer skill level, spare parts availability, software documentation, planning, installation/deinstallation, and consulting services.

The report is broken into five chapters. The Introduction (Chapter I) provides the scope and methodology, and the Executive Overview (Chapter II) summarizes the key findings of this study. Chapter III provides an analysis of the overall midrange system sample in order to show industry trends. Chapter IV contains the analyses of each of the ten midrange products surveyed in 1989. Chapter V provides summarized data from the ten individual products, allowing a vendor-by-vendor comparison. Appendixes at the end of the report provide a copy of the questionnaire used in the data collection and a list of definitions used in the report.

The report contains 150 pages, including 139 exhibits.

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Introduction

Introduction

This report, *Midrange System User Requirements*, is one of three deliverables for clients of the midrange systems module of INPUT's 1989 Customer Service Program. This study will analyze midrange system users' requirements for and satisfaction with the service and support they receive from their midrange system vendors. The next report, *Service Vendor Analysis—Midrange Systems*, will be a study comparing the service organization and offerings of leading midrange system vendors. The report, *U.S. Customer Service Market*, will provide both current market sizing and five-year forecasts for the entire customer service market, as well as for the midrange systems market.

A Scope

This report analyzes the service requirements of users of the following midrange system products: AT&T 3B; Concurrent Computer Corporation 32XX; Data General MV series; DEC VAX 8XXX; HP 3000; IBM 937X; IBM AS/400; Prime 9X5X; Tandem Nonstop, TXP, and VLX; and Wang VS. Each individual user group is analyzed separately, and the total sample is analyzed as a group to provide an industry standard.

Each analysis begins with an examination of the contracted service coverage. Next, each analysis measures product reliability and vendors' abilities to optimize system availability through response time and repair time. The criticality of system availability warrants the in-depth analysis of response and repair time which is given. Then, each analysis examines the user requirement for and satisfaction with traditional elements of hardware maintenance, software support, and ancillary services. In each section, user satisfaction is tested in service areas such as engineer skill level, spare parts availability, software documentation, planning, installation/deinstallation, and consulting services.

Where appropriate, comparisons to the 1988 user service requirements are made to illustrate trends in user satisfaction.

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The report is broken into five chapters. The Introduction (Chapter I) provides the scope and methodology and the Executive Overview (Chapter II) summarizes the key findings of this study. Chapter III provides an analysis of the overall midrange system sample in order to show industry trends. Chapter IV contains the analyses of each of the ten midrange products surveyed in 1989. Chapter V provides summarized data from the ten individual products, allowing a vendor-by-vendor comparison. Appendix A provides a copy of the questionnaire used in the data collection, and Appendix B contains a list of definitions used in the report.

B Methodology

For this report, INPUT surveyed 400 users of midrange systems to determine their requirement for and satisfaction with a wide range of services. The midrange systems sample breakdown is presented in Exhibit I-1. INPUT targeted the leading information systems (IS) executive of each company for the interview. The interviews were performed by telephone and lasted approximately thirty minutes. A wide variety of industries were represented in the sample, as illustrated in Exhibit I-2. INPUT emphasizes the value of telephone interviews over other data gathering methods (i.e., mail surveys, focus group research) because of the ability to control the sample size, the source of the information, and the ability to probe for more complete answers.

After the interview process was completed, the data was entered into a dBASE III Plus (Ashton-Tate Corporation) data base and analyzed using ABstat (Anderson Bell). The calculations for percent of respondents satisfied are performed on the file. INPUT calculates percent satisfied by examining and evaluating the user requirement versus the service received. Quality control is performed at each step—during the interview process, the data entry process, and during data analysis—to ensure data integrity.

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EXHIBIT I-1

Midrange System
User Sample Breakdown

Manufacturer	Model	Number of Interviews
AT&T	3B0	40
Concurrent	32XX	40
Data General	MV	40
DEC	VAX 8XXX	40
HP	3000	40
IBM	937X	40
IBM	AS/400	40
Prime	9X5X	40
Tandem	Nonstop, TXP, VLX	40
Wang	VS	40
Total		400

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EXHIBIT I-2

Industries Represented in Sample

Industry	Vendors										
	AT&T	Concurrent	Data General	DEC	HP	IBM 937X	IBM AS	Prime	Tandem	Wang	Total
Discrete Manufacturing	2	1	2	9	9	9	7	9	4	2	54
Process Manufacturing	3	7	3	8	6	7	10	6	7	9	66
Retail Distribution			2	2	2	1	2	2	4	4	19
Wholesale Distribution	1	1			2	2	1		4	1	12
Banking/Finance	2	2		3	3	2				1	13
Insurance		4	3		1			3	1		12
Transportation	2	2		1	1		1		1		8
Telecommunications		1			1	1	3				6
Medical	3	1	6	1		2	4	1	3	1	22
Education	15	6	1	7	4	4		6	1		44
State/Local Government	3	2	6	2		2		2		3	20
Federal Government		5	12					1	1	5	24
Utilities		1					1	1			3
Services	8	7	4	6	9	10	11	8	14	14	91
Other	1		1	1	2			1			6
Total	40	40	40	40	40	40	40	40	40	40	400

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Executive Overview

Executive Overview

This Executive Overview is provided as a convenient summary of the main findings of this study. It is presented in a format that facilitates the use of this section as a short presentation, with each exhibit accompanied by text that acts as a script detailing the key findings and conclusions.

INPUT has been tracking the service requirements and satisfaction level in the midrange systems marketplace (in this format) since 1983. During this period, INPUT has seen opposing pressures—there is increased demand for system availability and improved support, but at the same time, vendors have been under pressure to lower the total cost of ownership of their products. The vendors have responded by utilizing information systems to support their offerings, remote support to lower costs and improve system availability, and discounting schemes to lower their prices and therefore the cost of ownership. This has resulted in lower margins for service and also has slowed or stopped the growth of service revenue.

During the past few years, vendors have expanded the definition of service and support to encompass a wide range of support services such as planning, consulting, training, network management, operational support and disaster recovery. As a result, the emphasis has moved to some extent away from remedial maintenance to performance or operational support. INPUT tracks the user requirements and the user perception of the services received in these new areas under the heading of ancillary support.

Midrange system users still place the greatest importance on system availability and all of the items that contribute to achieving high system availability.

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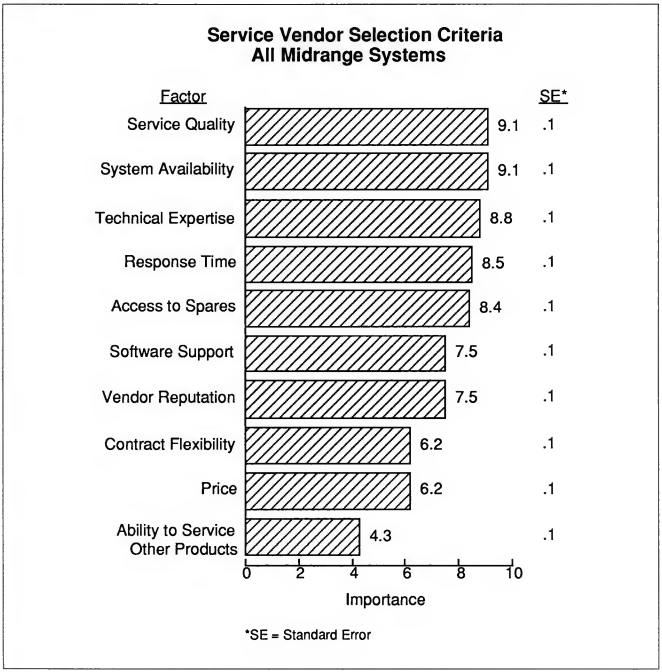
A

Price Ranked Sixth of Ten Items Important to Users

As shown in Exhibit II-1, system availability and service quality are the most important factors considered by users in selecting a service vendor. They are followed very closely by technical expertise, response time and access to spares.

EXHIBIT II-1



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Price is ranked sixth in the list of ten items considered. INPUT believes that this indicates that price may be important in the cost-of-ownership equation of product selection, but that users first determine the vendor's ability to assure high system availability—if these are equal between vendors, then price becomes a consideration.

Multivendor support or the ability to support other vendors' products is rated the least important item in service vendor selection. This is very interesting, since during the past few years many vendors have announced multivendor support offerings. Users do not think this ability is important in their decision-making process of selecting a service vendor.

B

Satsifaction Drops after 98% System Availability Level

The midrange systems market has seen an increase in the use of technological advances in the design and manufacturing of systems that dramatically increases the reliability and performance of end products. As a result, many systems are sold that make use of fault tolerance, multiple processors, and other forms of redundancy of processing capabilities. At the same time, service vendors have also made use of technological advances such as remote diagnostics and artificial-intelligence-based tools to improve service performance.

These developments have not been lost on the end-user community, which now expects increased levels of system availability. In fact, 58% of the users surveyed in 1989 expect 100% availability.

Exhibit II-2 compares midrange system availability requirements for increasing levels of system availability with service vendors' ability to satisfy those requirements. For example, 60% of the users required system availability of 99% or higher, and the vendors were able to satisfy 36% of those users. The vendors therefore have a significant problem—or perhaps a significant opportunity, if they can satisfy this need.

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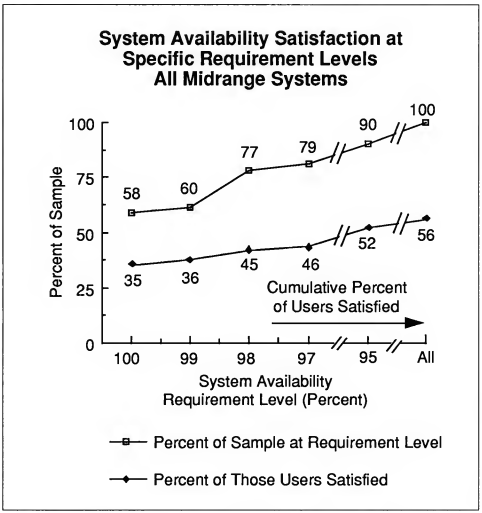
EXHIBIT II-2



As user acceptance of networked systems and local-area networks increases, midrange system vendors will need to find ways to increase system availability.

C

Leading System Availability Vendors

The five leading midrange vendors, ranked by their ability to satisfy their users' requirements, are displayed in Exhibit II-3. The five top vendors are IBM (with the 937X system), with 74% satisfied; Concurrent and Data General tied with 73% satisfied; Prime with 68% satisfied; and IBM (with the AS/400 system), with 67% satisfied. IBM and Data General moved into the top five this year while DEC, HP and AT&T moved out.

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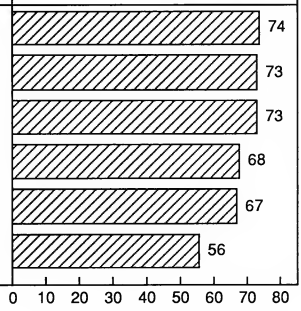
EXHIBIT II-3

Leading Midrange Systems Vendors
System Availability

Rank	Vendor	System Availability		Users Satisfied (Percent)
		Required (Percent)	Received (Percent)	
1	IBM 947X	97.3	97.5	74
2	Concurrent	97.6	97.8	73
2	Data General	96.9	96.7	73
3	Prime	97.1	97.4	68
4	IBM AS/400	95.9	98.0	67
	All	97.5	97.4	56



Note that some vendors with higher absolute system availability received high values (such as the IBM AS/400 with actual availability of 98.0), but did not rank high in the percent ranking. This illustrates the critical need to understand and meet the needs of individual users.

The total sample required 97.5% system availability, received 97.4%, and 56% of the users received the availability that they needed.

D

Midrange System Users Still Voice High Requirements

The scattergram plots the required and received levels of service reported as most important by the midrange system users in each of the following areas of service: hardware maintenance (including overall satisfaction with hardware maintenance and parts availability), software support (including overall satisfaction with software support, software reliability, software engineer skill, and software documentation), and ancillary services.

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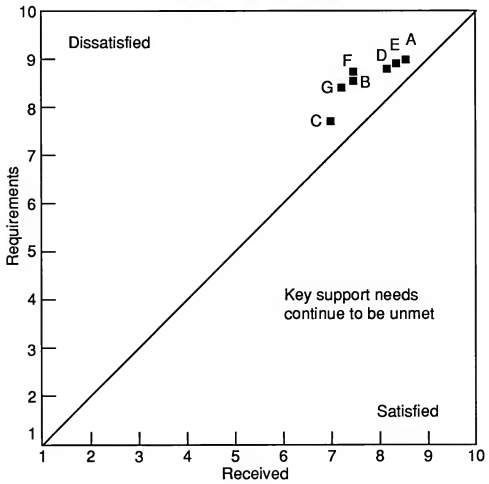
EXHIBIT II-4



Key	Service	Required	Received
A	Overall Hardware Maintenance	9.0	8.5
B	Overall Software Support	8.5	7.5
C	Overall Ancillary Services	7.8	7.0
D	Spares Availability	8.8	8.1
E	Hardware Engineer Skill	8.9	8.3
F	Software Engineer Skill	8.7	7.5
G	Software Documentation	8.4	7.2

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The individual items plotted are described at the bottom of the chart. The greater the distance from the diagonal line, the greater the problem in terms of meeting user requirements. Clearly, users' key support needs are still not being met.

Overall hardware maintenance received the highest rating in terms of service level received (8.5); ancillary service overall received the lowest rating (7.0).

In the area of ancillary services, users are becoming increasingly perceptive of the importance of planning and other services involving the operational support of their systems. Midrange system users place high importance on such services; vendors should place equal importance on meeting those needs.

Software documentation is an area that still requires attention. This item continues to receive high requirement levels, but poor performance ratings. Poor documentation not only affects user satisfaction with the performance of the product, but also increases the overall cost of supporting the users.

E

Satisfaction Improving, but More Improvement Needed

In the 1988 INPUT user survey of midrange users, overall hardware maintenance and overall software support were the only two areas in which more than 50% of the users were satisfied with the service level they received. In 1989, only in the area of software documentation were more than 50% of the users dissatisfied. This is certainly an improvement, but the objective should be to move all areas to the 80% or higher percent satisfied level.

AT&T, Concurrent and HP have achieved 80% or higher satisfaction levels in overall hardware support and in overall software support. In the ancillary services area, Prime joins these three other vendors by moving to the 85% satisfied level.

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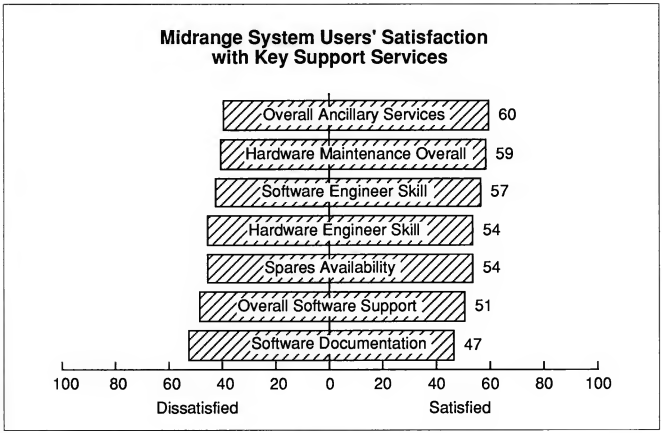
EXHIBIT II-5



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Midrange Systems User Service Requirements—All Vendors

III

Midrange Systems User Service Requirements—All Vendors

In 1989, INPUT surveyed data processing officials at 400 midrange system sites concerning their attitudes toward, and satisfaction with, the support they receive from their midrange system manufacturer. This sample size compares to 399 sites surveyed in 1988.

This year, INPUT analyzed ten midrange system support offerings from leading vendors in the market: AT&T 3B, Concurrent Computer Corporation 32XX, Data General MV series, Digital Equipment Corporation VAX 8XXX, Hewlett-Packard 3000, IBM 9370, IBM AS/400, Prime 9X5X, Tandem (Nonstop, TXP, and VLX), and Wang VS. INPUT targeted MIS directors, data processing managers, and computer operations managers at each site for interviews, all of which were conducted by telephone using the questionnaire contained in the appendix.

The respondents were asked to rate the importance of ten items in the decision process to select a service vendor for the midrange systems they had installed. A rating of ten indicates an item of most importance, while a rating of one indicates a item of least importance. Exhibit III-1 presents the results obtained from the total sample of all vendors combined.

Service quality and system availability were rated the most important items, with a mean rating of 9.1. This was followed by technical expertise, response time and access to spare parts. Price—with a rating of 6.2—was sixth in order of importance, indicating that users are more concerned with assuring that the systems are available for their needs than the price of the services provided.

During the past several years, many hardware vendors have announced service offerings that support other vendors' products. The users in this survey rated the ability to service other vendors' products at 4.3, which was the lowest of the ten items that they rated. This would indicate that multivendor service is not a critical user requirement.

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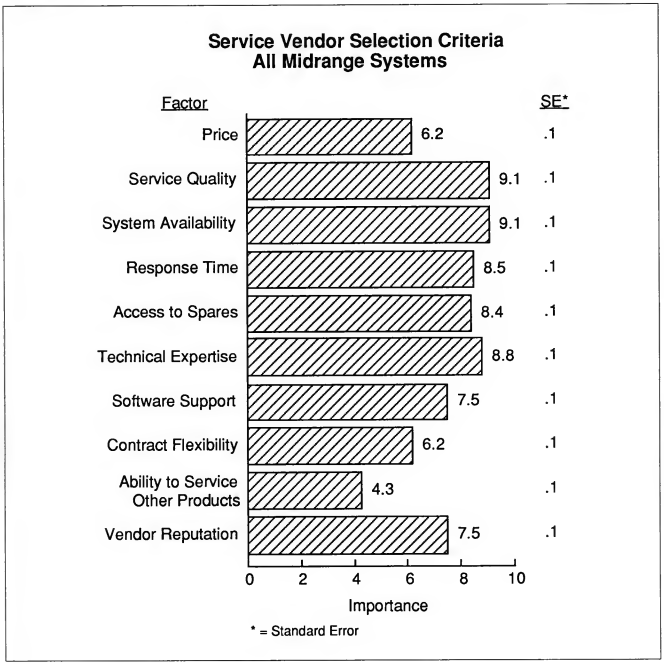
EXHIBIT III-1



Trends in contract coverage are shown in Exhibit III-2. Two-thirds of the users still report Monday-through-Friday contract coverage, but the percentage continues to drop slightly each year. The hours of coverage remained about the same as reported in 1988. INPUT believes that the trend for increased coverage will continue, due to increased user dependence on the systems and due to the competitive pressure in the market-

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place to match IBM's twenty-four-hour, seven-day-per week coverage on all contracts.

EXHIBIT III-2

Service Contract Coverage
All Midrange Systems

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	64	66
Monday - Saturday	3	4
Monday - Sunday	33	30
Hours Covered		
1 - 9	56	54
10 - 16	13	14
17 - 24	31	32

An analysis of the trend in system interruptions is presented in Exhibit III-3. The number of interruptions per month decreased from 1.2 in 1988 to .59 in 1989. Some reduction in system interruptions was achieved by all vendors except Prime Computer. Concurrent Computer improved from 1.2 to 1.0, but did not achieve the very large decrease reported for the other vendors' products.

The percent of interruptions caused by software decreased, while the percent caused by hardware increased. This would lead to the conclusion that most of the reduction in the number of system interruptions was due to improvements in software.

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EXHIBIT III-3

System Interruption Analysis
All Midrange Systems

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.6	.06	1.20	.10
Hardware-caused	63	2	56	2
System software-caused	13	1	15	2
Application software-caused	4	1	8	2
Other-caused	20	2	21	3

Exhibits III-4 and III-5 present users' requirements for and their perception of the services received in the areas of system availability, response time, and repair time. In 1988, users stated a requirement for system availability of 96.9%. In 1989, the requirement increased to 97.5%.

In 1988, users reported receiving 96.1% availability and in 1989 this improved to 97.4%. The percent of users satisfied with system availability remained the same at 56% satisfied. The IBM 937X had the highest percent of users satisfied with system availability (74%) and the Wang VS had the lowest percent (18%).

The percent of users satisfied with response time and repair time improved between 1988 and 1989, to 90% and 91% respectively. Response time varied from a low of one hour for the IBM AS/400 to a high of 11.3 hours for the AT&T 3B. Repair time varied from a low of 1.6 hours for the Wang VS to a high of nine hours for the AT&T 3B.

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EXHIBIT III-4

System Availability Performance Analysis
All Midrange Systems

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	97.5	0.3	97.4	0.2
Response time (Hours)	4.5	0.3	3.9	0.3
Repair time (Hours)	4.7	0.4	4.0	0.4

EXHIBIT III-5

System Availability Performance Satisfaction
All Midrange Systems

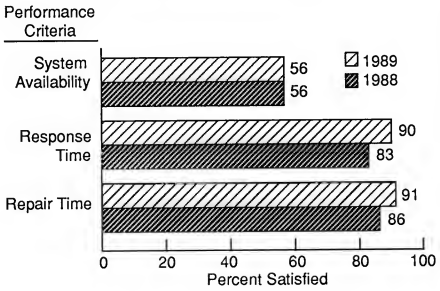

Exhibit III-6 displays the percent of users at each requirement level and the percent of those users satisfied. For example, sixty percent of the sample required a system availability of 99% or higher, and only 36% of these users achieved the availability that they required. Vendors clearly have a long way to go in order to satisfy user demands for this very important requirement.

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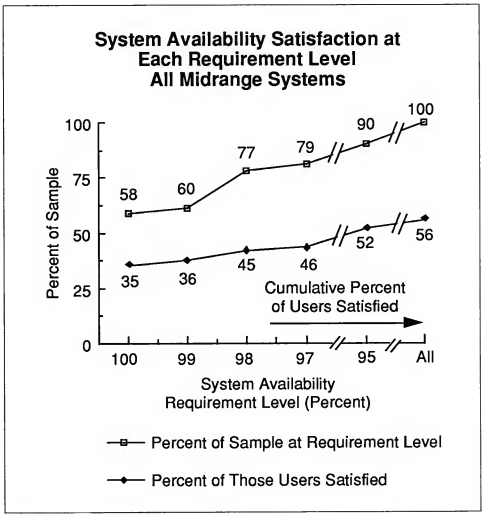
EXHIBIT III-6



Key hardware support requirements versus users' perception of the services delivered are displayed in Exhibits III-7 and III-8. The requirements for these items range from 7.8 to 9.0, and the vendors fail to meet the requirements for all of them. This is actually worse than the 1988 results, since in 1988 vendors had a higher service level for hardware telephone support than was required.

The percent of satisfied users for both spares availability and hardware maintenance overall improved significantly in 1989. The percent of users satisfied with hardware maintenance overall varied from a high of 85% at AT&T to a low of 13% at Wang. Fifty-nine percent of the users were satisfied with hardware maintenance overall.

The percent of users satisfied with hardware engineer skill dropped from 60% to 54%. This was caused by lower percents at Data General, DEC, IBM, Prime and Wang. AT&T, Concurrent and Hewlett-Packard increased their percent of satisfied users.

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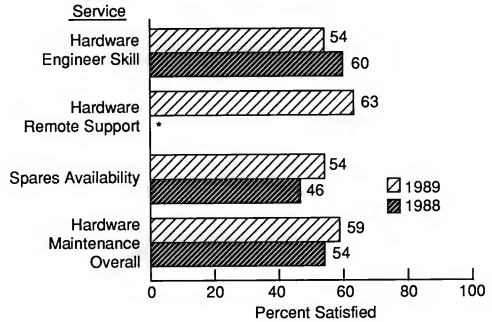
EXHIBIT III-7

Hardware Maintenance Required versus Received All Midrange Systems

Service	Required		Received	
	Mean	SE	Mean	SE
Hardware engineer skill	8.9	0.1	8.3	0.1
Hardware remote support	7.8	0.2	7.3	0.1
Spare parts	8.8	0.1	8.1	0.1
Hardware maintenance overall	9.0	0.1	8.5	0.1

EXHIBIT III-8

Hardware Maintenance Satisfaction Levels All Midrange Systems



* 1988 information not available

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Key software support requirements and users' perception of service received are presented in Exhibits III-9 and III-10. Vendors failed to meet the mean requirements on all five of the items surveyed. Software documentation continues to be the number one problem area, although the percent of satisfied users increased from 30% in 1988 to 47% in 1989. AT&T, Concurrent, DEC, HP and Prime all contributed to this improvement in satisfaction.

EXHIBIT III-9

Software Support
Required versus Received
All Midrange Systems

Service	Required		Received	
	Mean	SE	Mean	SE
Software engineer skill	8.7	0.1	7.5	0.1
Software remote support	8.0	0.2	7.1	0.2
Software documentation	8.4	0.1	7.2	0.1
Operational training	7.1	0.2	6.3	0.2
Software support overall	8.5	0.1	7.5	0.1

Gains were also made in the percent of users satisfied with the software engineer skill level. Software remote support however, was an area where the percent of satisfied users declined. The percent of users satisfied with overall software support remained the same in 1989. AT&T had the highest percent of satisfied users—89% satisfied—and Wang the lowest, with only 4% satisfied. Concurrent was very close behind AT&T, with 88% satisfied, and Hewlett-Packard was not far behind, with 81% satisfied. Apparently these three vendors have a secret that would be very useful to others.

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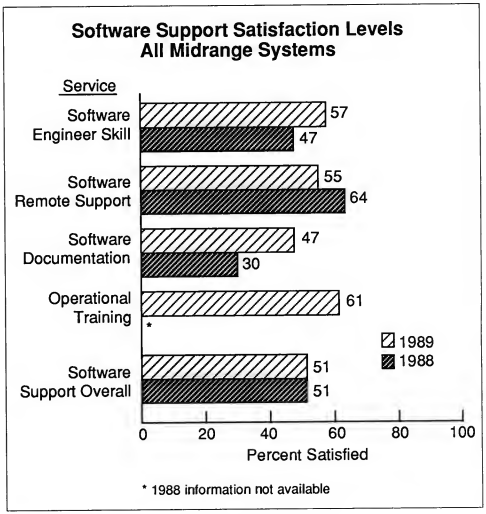
EXHIBIT III-10



Exhibits III-11 and III-12 present an analysis of the key ancillary service items. Installation/deinstallation continues to be the item with the highest requirement level and maintenance training the area with the lowest requirement level. Users' perception of the services delivered are lower than the requirements in all cases, although there has been some year-to-year improvement in the percent of satisfied users in the areas of preinstallation planning, consulting, and network design/planning. Concurrent has 91% of its users satisfied with ancillary services. AT&T, Hewlett-Packard and Prime all have about 85% satisfied. Wang has the lowest percent of satisfied users, with only 3% satisfied with ancillary services.

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EXHIBIT III-11

Ancillary Services
Required versus Received
All Midrange Systems

Service	Required		Received	
	Mean	SE	Mean	SE
Maintenance training	5.5	0.2	4.7	0.2
Preinstallation planning	7.4	0.2	6.8	0.2
Consulting	6.3	0.2	5.8	0.2
Installation/Deinstallation	8.1	0.1	7.5	0.1
Network design/planning	6.6	0.2	5.8	0.2
Ancillary services overall	7.8	0.1	7.0	0.1

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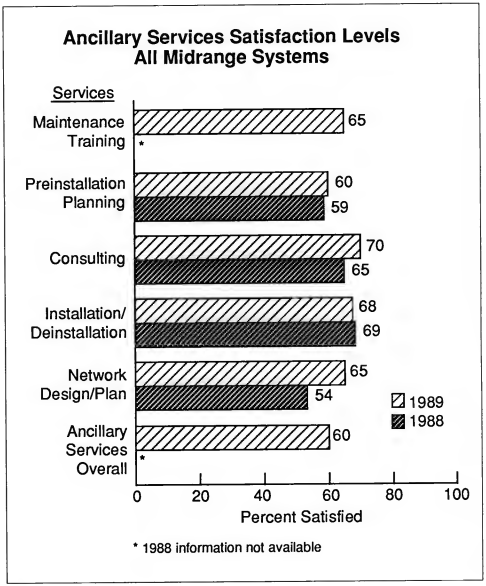
EXHIBIT III-12



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Vendor Performance Analyses

Vendor Performance Analyses

In Chapter III, INPUT presented an analysis of the midrange system user environment as reported by 400 current users of midrange systems. In this chapter, specific user service requirements of leading midrange system vendors are analyzed individually, and a comparison of how well each vendor meets the users' requirements is provided. Historical trend information is also provided on many of the key variables.

Each analysis begins with a display of the user's contracted coverage, in terms of days and hours of contract coverage. Next, specific machine and service performance data that relate to system interruptions, system availability, and response and repair time is presented. This section is important, since users place the greatest weight on system availability when judging service satisfaction.

Additional performance analyses are provided that provide detailed comparisons of each vendor's success (or failure) at meeting users' requirements for hardware maintenance, software support, and ancillary services. Each analysis measures user satisfaction with key items such as spare parts availability, hardware and software engineer skill levels, software product reliability, installation planning and implementation, and documentation support.

A

AT&T

In 1989, INPUT surveyed 40 users of AT&T 3B minicomputers (three 3B5s and 37 3B2s). This sample contained users from the education, services, medical, process manufacturing, state and local government, transportation, banking/finance, discrete manufacturing, wholesale distribution, and other industries.

Exhibit IV-1 presents the contractual service coverage of the AT&T sample, with the majority of users electing prime-shift coverage (Monday through Friday, nine hours per day), and only 17% electing around-the-clock coverage, seven days per week.

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EXHIBIT IV-1

Contract Coverage
AT&T

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	83	81
Monday - Saturday	0	0
Monday - Sunday	17	19
Hours Covered		
1 - 9	78	79
10 - 16	5	0
17 - 24	17	21

Systems interruptions per month, shown in Exhibit IV-2, continued decrease to an average of one-half (.5) per month. This is the second consecutive year that systems interruptions have decreased for AT&T, indicating a significant improvement in reliability. Most of the improvement is apparently a result of improved stability of the system software. Sixty-six percent of the system interruptions are caused by hardware.

Exhibit IV-3 displays the required versus the received mean information for the key areas of system availability, response time and repair time. AT&T usually exceeds customer requirements for repair time. System availability and response time, on the other hand, generally do not meet the customer requirements. The response time required and received for AT&T is much higher than for other vendors. Apparently AT&T has been able to set a much longer expectation level with their users than have other vendors.

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EXHIBIT IV-2

System Interruption Analysis
AT&T

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.5	0.1	0.9	0.2
Hardware-caused	66	7.6	58	7.2
System software-caused	16	5.3	22	5.6
Application software-caused	10	3.8	11	4.6
Other-caused	8	4.2	9	4.3

EXHIBIT IV-3

System Availability Performance Analysis
AT&T

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	96.4	1.2	95.9	1.2
Response time (Hours)	9.4	1.6	11.3	2.1
Repair time (Hours)	9.1	1.8	9.0	1.9

The historical trend of the percent of satisfied users for these key factors is shown in Exhibit IV-4. The percent satisfied with system availability decreased to 59% in 1989. This is somewhat lower than six of the other products surveyed. Response time, on the other hand, improved to 85% satisfied. The percent satisfied with repair time dropped slightly, to 83%.

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EXHIBIT IV-4

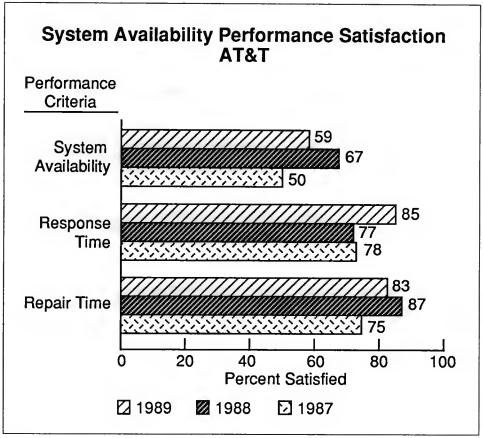

Exhibit IV-5 shows that AT&T satisfies about the same percent of its users at each requirement level. For example, 56% of the users require 100% availability—54% are getting what they require. Seventy-seven percent of the users require 98% or higher availability, and 55% are getting it. AT&T has increased the percentage of satisfied users at the 100% availability requirement level, from 27% in 1988 to 54% in 1989.

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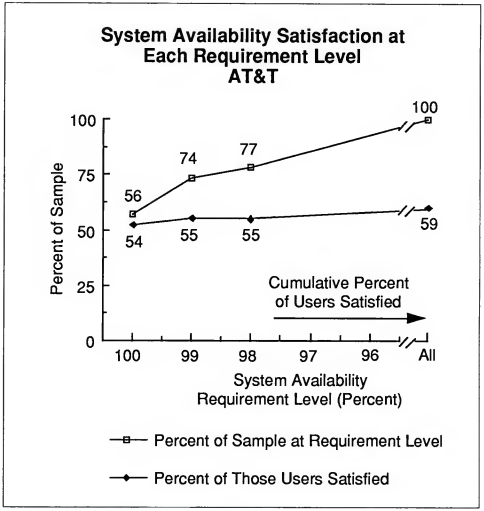
EXHIBIT IV-5



In 1989, AT&T exceeded the requirements for all four areas of hardware maintenance, as shown in Exhibit IV-6. This improvement over 1988 can be seen in Exhibit IV-7, where the percent satisfied with hardware engineer skill, spares availability and hardware maintenance overall increased significantly.

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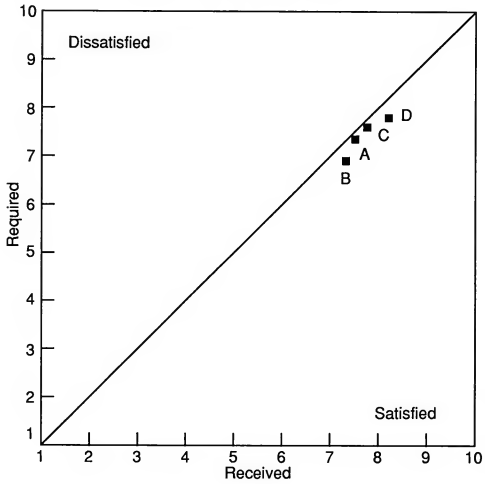
EXHIBIT IV-6

Hardware Maintenance
Required versus Received
AT&T



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	7.3	0.4	7.5	0.3
B	Hardware Remote Support	6.9	0.4	7.3	0.4
C	Spare Parts	7.6	0.4	7.7	0.3
D	Hardware Maintenance Overall	7.8	0.3	8.2	0.3

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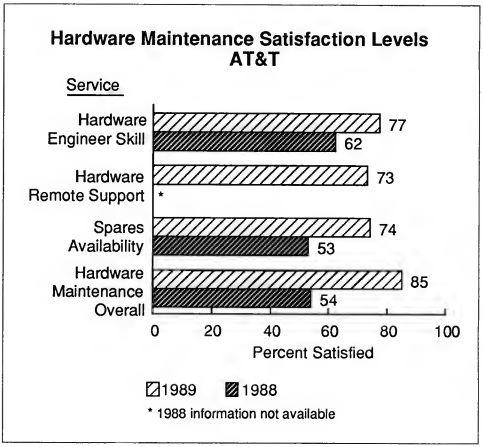
EXHIBIT IV-7



Software support also improved in 1989, as shown in Exhibits IV-8 and IV-9. The mean software support received exceeded requirements in all five areas, and the percent of satisfied users increased for software engineering skill, software documentation and software support overall. Software documentation, with 89% satisfied, was the highest score of all vendors surveyed.

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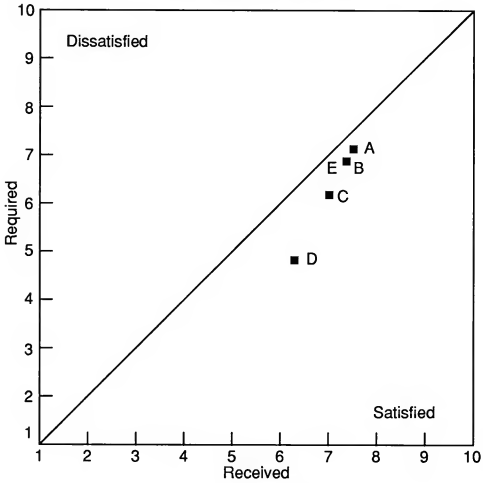
EXHIBIT IV-8

Software Support
Required versus Received
AT&T



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	7.1	0.6	7.5	0.5
B	Software Remote Support	6.9	0.5	7.4	0.6
C	Software Documentation	6.2	0.5	7.0	0.4
D	Operational Training	5.8	0.7	6.3	0.6
E	Software Support Overall	6.9	0.5	7.4	0.4

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EXHIBIT IV-9

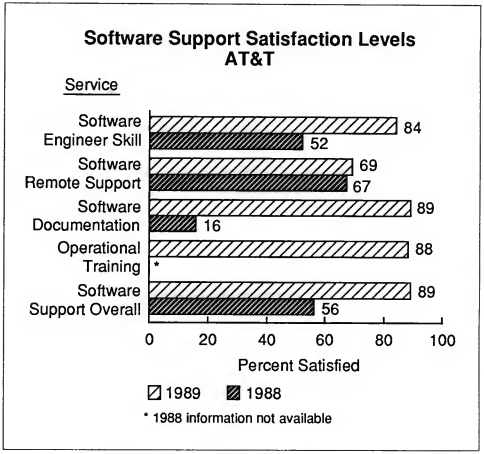

Exhibit IV-10 presents the requirements for ancillary services and how well AT&T met those requirements. The service received exceeded the requirements in all areas, although it is important to note that the standard errors are quite high.

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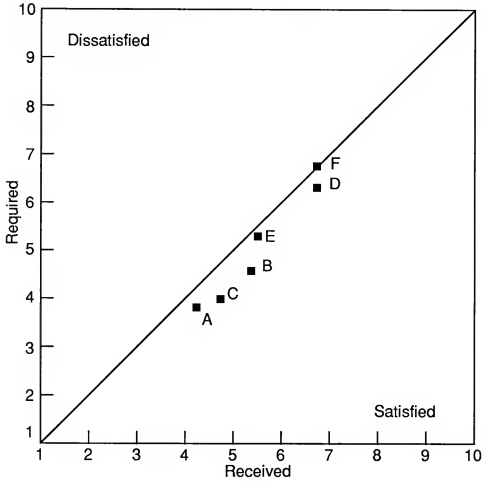
EXHIBIT IV-10

Ancillary Services
Required versus Received
AT&T



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	3.9	0.6	4.2	0.6
B	Preinstallation Planning	4.7	0.6	5.3	0.7
C	Consulting	4.0	0.6	4.7	0.6
D	Installation/Deinstallation	6.4	0.6	6.7	0.6
E	Network Design/Planning	5.2	0.7	5.5	0.5
F	Ancillary Services Overall	6.6	0.5	6.7	0.4

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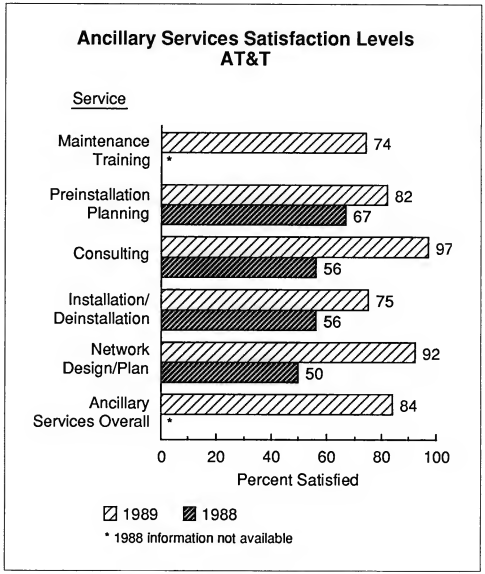
The percent of users satisfied with ancillary services (Exhibit IV-11) showed significant improvement over 1988 in the areas of preinstallation planning, consulting, installation/deinstallation, and network design/planning.

AT&T has made significant progress since 1988 in improving the percent of satisfied users of almost all of its services. The percent of users satisfied with system availability did drop to 59% in 1989 however, and this certainly deserves attention since it is the most important factor in the eyes of most users.

EXHIBIT IV-11



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B

Concurrent Computer Corporation

In 1989, INPUT surveyed 40 users of Concurrent Computer Corporation's 32xx superminicomputer system regarding the service and support they received from their vendor. The user sample was fairly diverse, with six users from education, seven from government, four from insurance, seven from process manufacturing, seven from services, two from banking and finance, two from transportation, and the remaining five from other industries.

Exhibit IV-12 presents the trends in contract coverage for Concurrent users between 1988 and 1989. There has been some increase in the Monday-through-Sunday and the sixteen-to-twenty-four-hour coverage, but still the vast majority of users contract for Monday-through-Friday, single-shift coverage.

EXHIBIT IV-12

Contract Coverage
Concurrent

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	89	90
Monday - Saturday	0	3
Monday - Sunday	11	7
Hours Covered		
1 - 9	78	80
10 - 16	11	15
17 - 24	11	5

The average system interruptions (Exhibit IV-13) decreased to 1.0 in 1989. However, the standard error (.5) was very high, which indicates that the sample had a wide variation in the number of system interruptions in 1989. The reduction was apparently due to a reduction in the number of application software- and user-related problems.

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EXHIBIT IV-13

System Interruption Analysis
Concurrent

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	1.0	0.5	1.2	0.1
Hardware-caused	75	6.2	61	5.8
System software-caused	12	4.0	12	3.4
Application software-caused	5	3.3	10	3.4
Other-caused	8	4.1	17	4.5

Exhibit IV-14 highlights the required and received levels of system availability, response time and repair time. The mean system availability and response time exceeded customer expectations, the repair time failed to meet customer expectations. Repair time received increased from 4.7 hours in 1988 to 8.4 hours in 1989. This was a very significant increase, even considering the high (2.0) standard error for this factor.

EXHIBIT IV-14

System Availability Performance Analysis
Concurrent

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	97.6	0.7	97.8	0.6
Response time (Hours)	5.8	1.0	5.3	1.0
Repair time (Hours)	7.1	1.7	8.4	2.0

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The percent satisfied trends for system availability improved again in 1989, as displayed in Exhibit IV-15. This is a very positive trend and a very high percent satisfied, compared to the average of all other vendors (i.e., 73% for Concurrent versus 56% for the average of all vendors combined). The response time remained about the same, but at a very high level—90%. Repair time, on the other hand, decreased to 84% satisfied. This was to be expected, considering the significant increase in the average repair time. The repair time certainly deserves attention, both from the standpoint of customer satisfaction and the increased cost of providing service on the products.

EXHIBIT IV-15

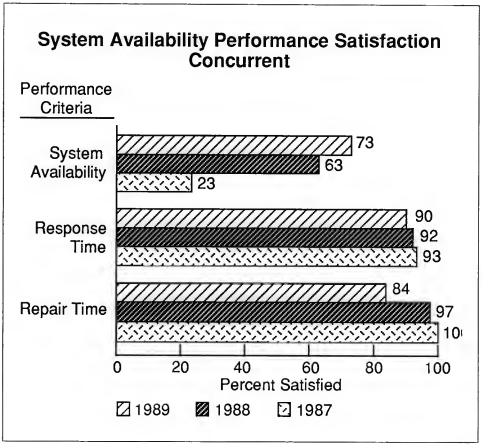

Exhibit IV-16 displays the distribution of system availability requirements and the percent of satisfied users at each requirement level. Seventy percent of the users require a system availability of 98% or higher; 61% of these users are getting what they require and are therefore satisfied. Concurrent manages to keep about the same percent satisfied at each requirement level. This indicates a good understanding of the various requirement levels of the users.

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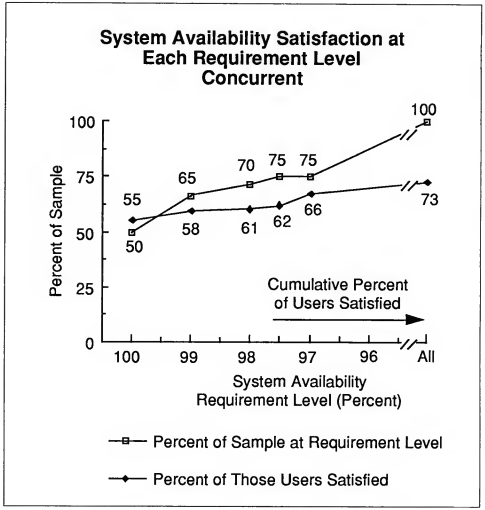
EXHIBIT IV-16



The key hardware support items are displayed in Exhibit IV-17. Concurrent does well in these areas, compared to the sample of all vendors combined. For example, in the sample of all vendors, the service received is lower than the service required for all four items. Concurrent has only one area—spare parts—where the mean support received is less than users require. The percent of satisfied users for these items is displayed in Exhibit IV-18. Concurrent has shown dramatic improvement in all of these items in 1989 and is very much ahead of the sample of all other vendors combined. The percent of users satisfied with spares availability increased from 49% to 78%, indicating a major improvement in this important item.

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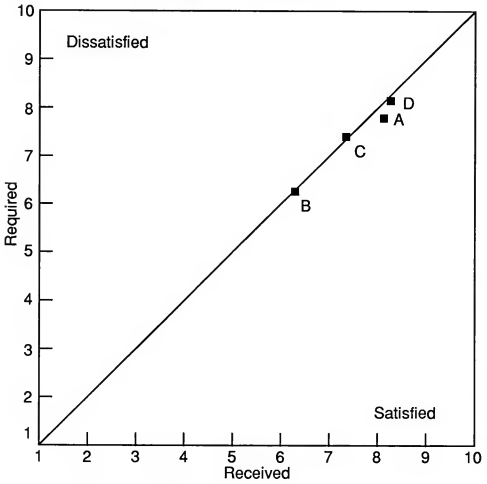
EXHIBIT IV-17

Hardware Maintenance
Required versus Received
Concurrent



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	7.8	0.4	8.1	0.3
B	Hardware Remote Support	6.2	0.6	6.3	0.5
C	Spare Parts	7.4	0.4	7.3	0.4
D	Hardware Maintenance Overall	8.1	0.3	8.2	0.2

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EXHIBIT IV-18

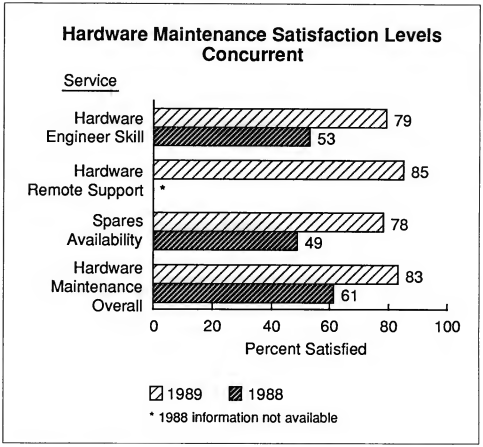

Exhibit IV-19 displays the requirements for and the service received for the key software support items. Users reported that overall software support and software engineer skill exceeded their requirements on the average. On the other hand, software remote support, software documentation and operational training fell below the average requirements. The overall sample of all vendors combined fell below the user requirements for all five items.

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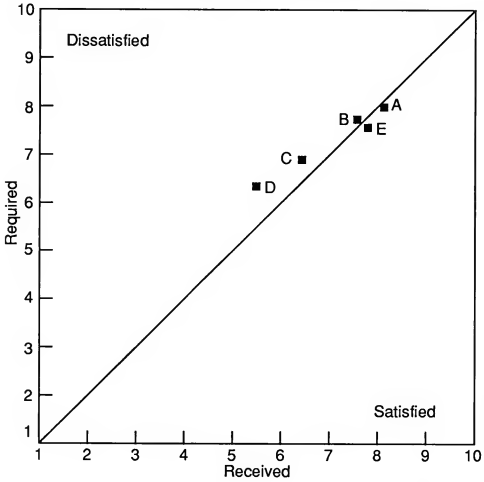
EXHIBIT IV-19

Software Support
Required versus Received
Concurrent



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.0	0.4	8.1	0.3
B	Software Remote Support	7.7	0.4	7.6	0.4
C	Software Documentation	6.9	0.5	6.4	0.3
D	Operational Training	6.3	0.8	5.5	0.8
E	Software Support Overall	7.6	0.3	7.8	0.3

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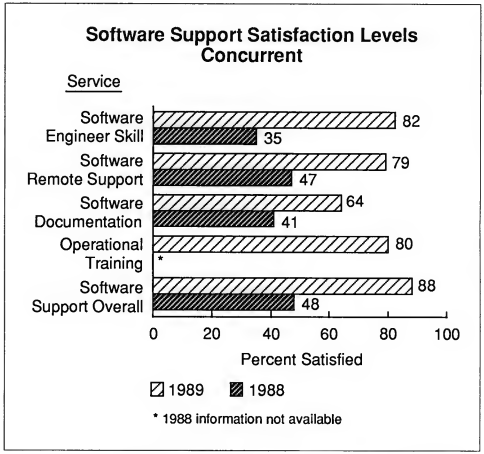
Dramatic improvement occurred in the percent of users satisfied with overall software support and software engineering skill, as shown in Exhibit IV-20. In fact, Concurrent achieved a 79% or higher percent of satisfied users in all items except software documentation. These are much higher scores than those obtained for all vendors combined.

EXHIBIT IV-20



Customer requirements for ancillary services and the customers' evaluation of the service received are displayed in Exhibits IV-21 and IV-22. The highest requirement for service is in the area of installation and deinstallation of equipment. Concurrent customers have a requirement of 7.8 compared to a requirement of 8.1 from the sample of all users combined. Concurrent provided a slightly higher service level than required for this service as well as for consulting. The percent of satisfied customers was quite high for all items, and significant year-to-year improvement was made in the areas of consulting and network design and planning. The overall percent satisfied for ancillary services of 91% compares favorably to the 60% satisfied from the sample of all vendors combined.

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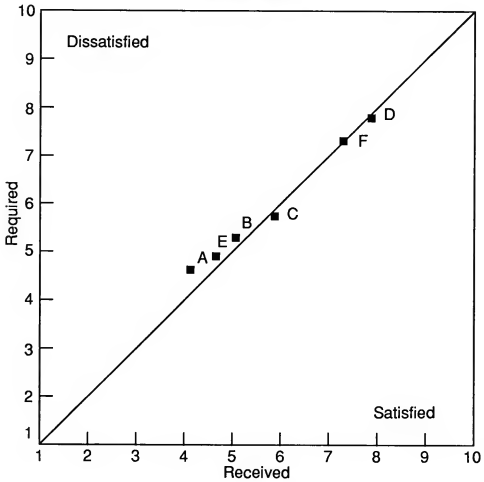
EXHIBIT IV-21

Ancillary Services
Required versus Received
Concurrent



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.6	0.9	4.1	0.9
B	Preinstallation Planning	5.2	0.8	5.1	0.8
C	Consulting	5.8	0.8	5.9	0.8
D	Installation/Deinstallation	7.8	0.5	7.9	0.5
E	Network Design/Planning	4.9	1.0	4.7	1.0
F	Ancillary Services Overall	7.3	0.5	7.3	0.5

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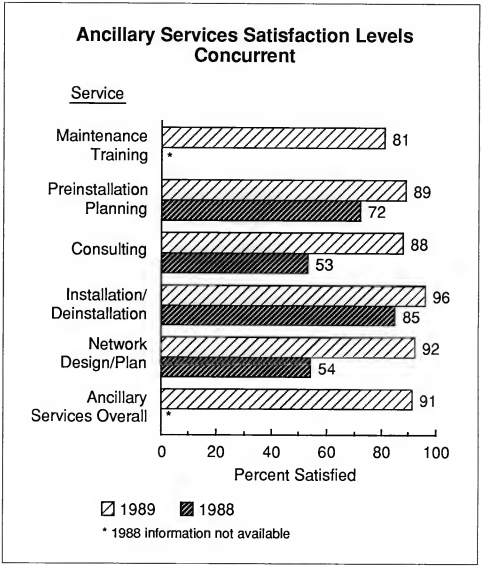
EXHIBIT IV-22



C

Data General

INPUT surveyed 40 users of DG MV series midrange systems, broken down as follows: twenty-nine MV/15000 and eleven MV/20000. The industry distribution included 18 from government, 6 from medical, 4 from services, 3 from insurance, 3 from process manufacturing and the remainder from retail, discrete manufacturing and education.

The contract coverage for the Data General sample is displayed in Exhibit IV-23. There was a slight change to more off-hour coverage in 1989, but about two-thirds of the users are still covered by a Monday-to-Friday, nine-hour-per-day contract. The shift is consistent with that of other vendors, and it may be due to the pressure to match IBM's twenty-four-hour, seven-day-per-week standard coverage on all contracts, which was announced in late 1987.

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EXHIBIT IV-23

Contract Coverage
Data General

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	68	70
Monday - Saturday	4	3
Monday - Sunday	28	27
Hours Covered		
1 - 9	65	63
10 - 16	12	17
17 - 24	23	20

Exhibit IV-24 presents the trends in system interruptions per month and the causes of these interruptions as reported by the users surveyed. Data General users reported a significant drop in the number of interruptions (1.2 per month to .5 per month). The percent caused by hardware dropped slightly, to 54%; the percent caused by software decreased from 24% to 13%, and the percent due to other problems increased from 20% to 33%. Other-caused problems are usually due to user errors or environmental factors. The significant decrease in system interruptions was therefore apparently caused by a combination of improved hardware reliability and fewer defects in the software.

The mean system availability required by Data General users was 96.9% (see Exhibit IV-25) and the mean received came very close to meeting that objective, with users reporting 96.7% received. In the area of response time and repair time, the mean received was lower than required, indicating that most users were satisfied with these items.

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EXHIBIT IV-24

System Interruption Analysis
Data General

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.5	0.1	1.2	0.2
Hardware-caused	54	6.9	56	6.3
System software-caused	9	3.9	17	4.3
Application software-caused	4	2.8	7	3.5
Other-caused	33	7.0	20	5.3

EXHIBIT IV-25

System Availability Performance Analysis
Data General

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	96.9	1.1	96.7	1.0
Response time (Hours)	7.6	1.4	7.1	1.4
Repair time (Hours)	5.4	1.2	4.1	0.9

The percent of users satisfied with system availability, response time and repair time is displayed in Exhibit IV-26. Data General achieved significant improvement between 1988 and 1989 in all three of these items. Satisfaction with system availability, with 73% of the users satisfied, compares with 56% satisfied from the sample of all vendors combined.

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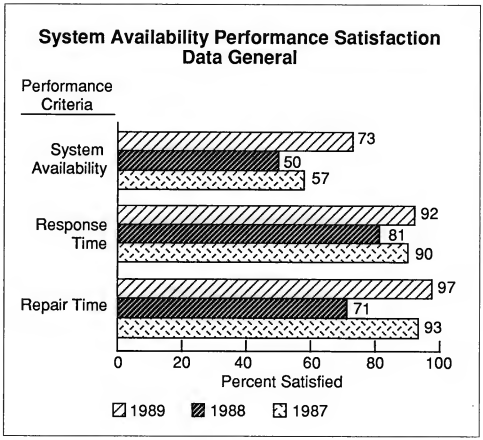
EXHIBIT IV-26



The 97% satisfied with repair time is very good, compared with 91% satisfied from the sample of all vendors combined. The 92% satisfied with response time compares with 90% satisfied from the sample of all vendors combined.

Exhibit IV-27 presents the percent of users at various system availability requirement levels and the percent of users satisfied at these various levels. For example, 68% of the users surveyed required system availability of 99% or higher, and Data General was able to satisfy 64% of those users. The percent of users satisfied at the various requirement levels is fairly constant, indicating that Data General is aware of and responsive to the different requirements of its users.

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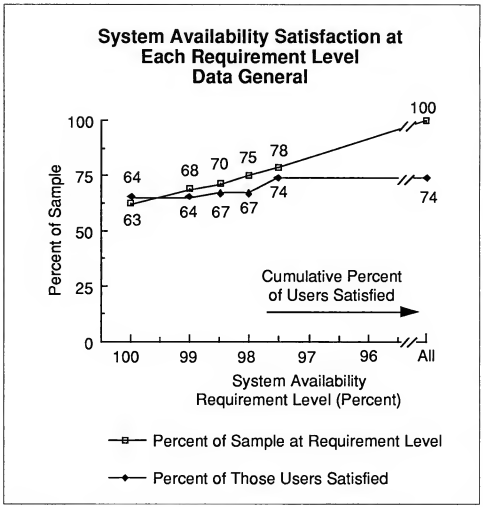
EXHIBIT IV-27



The key hardware maintenance support categories and hardware maintenance overall are displayed in Exhibits IV-28 and IV-29. Data General fails to meet the mean service requirements in any of the categories, but hardware engineer skill and spare parts are the items that require the most attention. The percent satisfied with hardware engineer skill dropped from 60% to 50% between 1988 and 1989. The percent satisfied with spares availability showed a significant improvement, increasing from 32% to 56% between 1988 and 1989.

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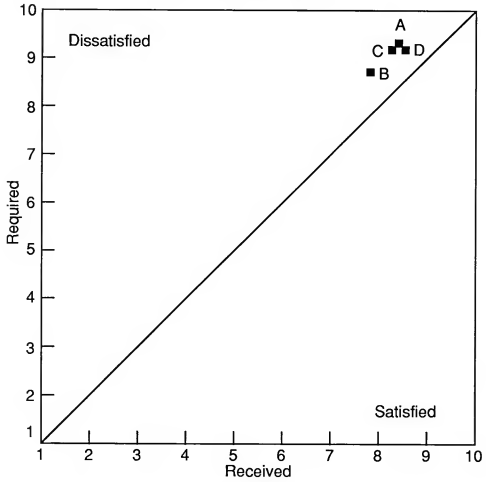
EXHIBIT IV-28

Hardware Maintenance
Required versus Received
Data General



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.3	0.1	8.4	0.2
B	Hardware Remote Support	8.7	0.3	7.9	0.3
C	Spare Parts	9.2	0.2	8.3	0.3
D	Hardware Maintenance Overall	9.2	0.1	8.5	0.1

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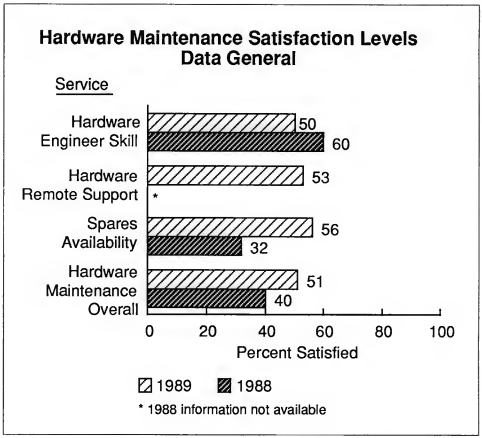
EXHIBIT IV-29



Exhibits IV-30 and IV-31 present information on software support requirements, software support received and the percent of users satisfied. Data General users have much higher requirements for software support than the average requirements of all vendors combined. For example, Data General users state a requirement of 9.4 for overall software support, and all vendors combined have a requirement of 8.5. Higher requirements are also stated for software engineer skill, software remote support, and software documentation.

The level of service received for software support is lower than required for all of the items surveyed. Data General users, however, receive about the same level of service as reported by the users of all vendors combined.

The percent of users satisfied in the software support area is very low, compared to all other vendors combined. For example, Data General has satisfied only 25% of its users for software support overall. This compares to 51% of the users satisfied in the sample of all vendors combined. The percent of users satisfied dropped significantly in the areas of software engineer skill and software remote support. These items certainly contributed to the overall low rating on software support and should be targeted for improvement in the future.

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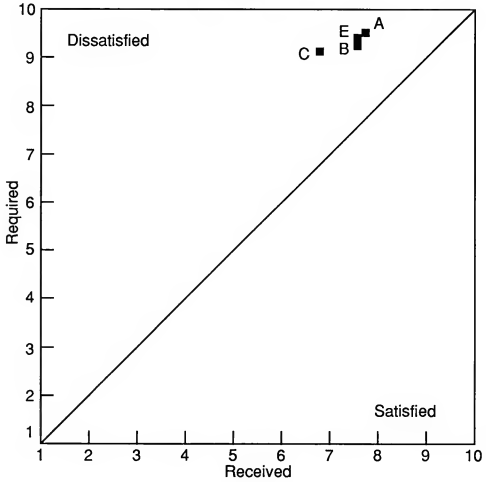
EXHIBIT IV-30

Software Support
Required versus Received
Data General



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	9.5	0.2	7.7	0.4
B	Software Remote Support	9.3	0.3	7.6	0.6
C	Software Documentation	9.2	0.3	6.8	0.4
D	Operational Training	**	-	**	-
E	Software Support Overall	9.4	0.3	7.6	0.4

** Insufficient response

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EXHIBIT IV-31

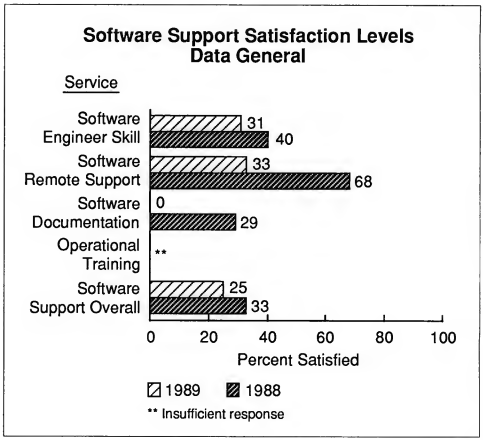

Exhibit IV-32 displays the results reported for ancillary services. Data General satisfied the average requirements of its users only in the area of consulting. The requirements set by the users, however, are higher for Data General users than for the users of all vendors combined. For example, Data General users state a requirement of 9.4 for installation/deinstallation. This compares to an 8.1 requirement for all vendors combined. Data General users received an 8.9 for installation/deinstallation compared to a 7.5 for all vendors combined.

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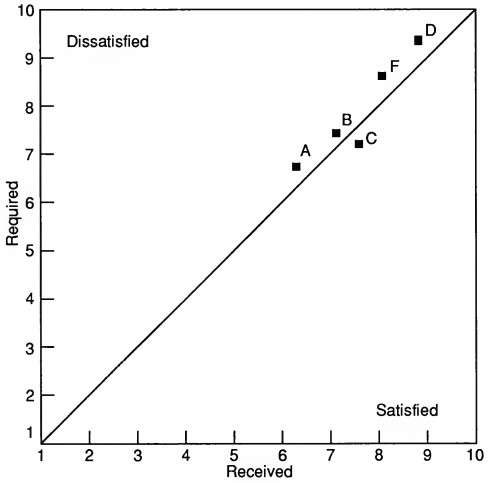
EXHIBIT IV-32

Ancillary Services Required versus Received Data General



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.7	0.8	6.3	0.7
B	Preinstallation Planning	7.4	0.6	7.1	0.5
C	Consulting	7.2	0.9	7.5	0.8
D	Installation/Deinstallation	9.4	0.2	8.9	0.2
E	Network Design/Planning	**	-	**	-
F	Ancillary Services Overall	8.6	0.3	8.1	0.2

** Insufficient response

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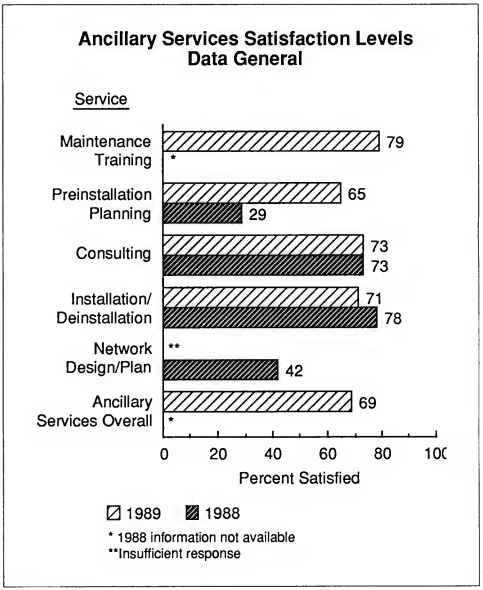
The percent of users satisfied in each category of ancillary service is displayed in Exhibit IV-33. Preinstallation planning improved from 29% satisfied in 1988 to 65% satisfied in 1989. The installation/deinstallation percent satisfied decreased in 1989 to 71%, but this is still higher than the 68% achieved by all vendors combined.

EXHIBIT IV-33



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D

DEC VAX 8XXX

The 1989 DEC VAX 8XXX sample of 40 users consisted of seven 8350 users, seven 8600 users, six 8650 users, five 8530 users, four 8700 users, three 8200 users, three 8250 users, two 8300 users, and the remainder 8550, 8810, or 8820 users. The DEC VAX 8XXX sample represented users from the discrete manufacturing (9), process manufacturing (8), education (7), services (6), banking/finance (3), retail distribution (2), and state and local government (2) industries, with the remainder from the medical, transportation and other industries.

Exhibit IV-34 provides an analysis of the DEC VAX 8XXX sample's contract coverage. The preponderance of users opted for prime-shift coverage (Monday through Friday, nine hours per day). The trend may be shifting, as evidenced by a higher percentage of users in the 1989 sample electing around-the-clock coverage, seven days per week than in the 1988 sample.

EXHIBIT IV-34

Contract Coverage
DEC

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	68	72
Monday - Saturday	10	11
Monday - Sunday	22	17
Hours Covered		
1 - 9	63	72
10 - 16	19	17
17 - 24	18	11

The system interruption analysis is presented in Exhibit IV-35 for the DEC VAX 8XXX sample. The number of reported system interruptions has seen a large drop, from 1.5 per month for the 1988 sample to 0.5 for the 1989 sample. There is also a greater percent of interruptions caused

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by hardware or application software problems than was seen in the 1988 sample. This slight increase in hardware-caused interruptions is not as significant as the large decrease seen when comparing the 1987 sample to the 1988 sample. In 1987, 75% of the interruptions were caused by hardware, as opposed to 50% in the 1988 sample and 58% in the 1989 sample.

EXHIBIT IV-35

System Interruption Analysis
DEC

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.5	0.1	1.5	0.3
Hardware-caused	58	6.6	50	7.0
System software-caused	9	3.0	15	3.7
Application software-caused	13	3.9	7	2.7
Other-caused	20	5.8	28	6.6

Exhibit IV-36 presents the system availability performance analysis. DEC VAX 8XXX users place greater demands on DEC for system availability, as seen in the mean system availability requirement of 98.0%. The mean system availability received was reported to be 97.1%, with Exhibit IV-37 showing 39% of the users satisfied with the availability received.

The mean response time received for the 1989 sample is over an hour less than that reported in 1988—2.1 hours in 1989 versus 3.2 hours in 1988. Even though the mean response and repair times received appear to be better than those required, a lower percentage of users reported satisfactory response and repair times in 1989 than in 1988 or 1987.

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EXHIBIT IV-36

System Availability Performance Analysis
DEC

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	98.0	0.9	97.1	0.7
Response time (Hours)	2.9	0.3	2.1	0.2
Repair time (Hours)	4.9	0.6	3.6	0.9

EXHIBIT IV-37

System Availability Performance Satisfaction
DEC

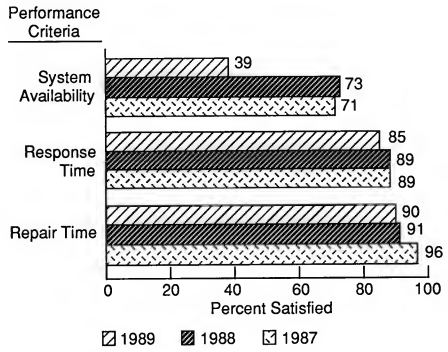

Exhibit IV-38 presents the system availability satisfaction at each requirement level. Sixty-six percent of DEC VAX 8XXX users reported a system availability requirement of 100%. This is just slightly higher than the 58% requiring 100% availability seen in the overall sample. Only 8% of the DEC VAX 8XXX users requiring 100% availability were satisfied with the availability received, as opposed to the 35% of the users being satisfied at 100% availability in the overall sample.

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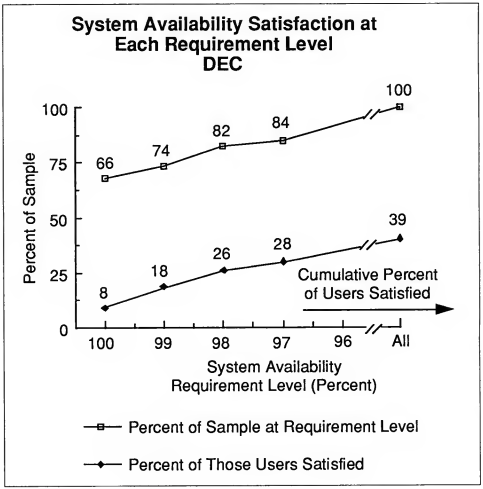
EXHIBIT IV-38



Hardware maintenance required versus received and satisfaction levels are presented in Exhibits IV-39 and IV-40. The DEC VAX 8XXX sample reported mean hardware maintenance requirements equal to or slightly greater than the overall sample, with mean services received greater than the overall sample, but not as high as the requirements. DEC appears to have a problem with the satisfaction levels of hardware engineer skill and spares availability—both dropped from 1988 levels.

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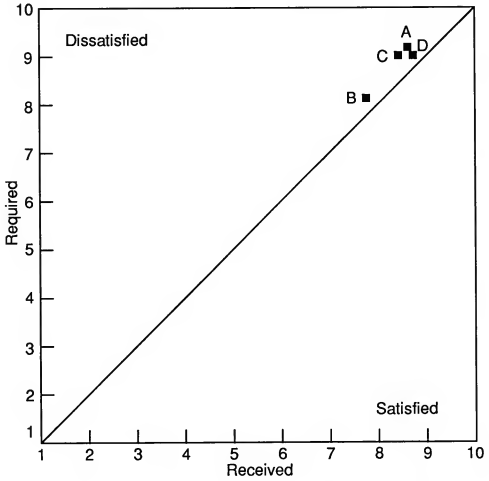
EXHIBIT IV-39

Hardware Maintenance
Required versus Received
DEC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.1	0.2	8.6	0.2
B	Hardware Remote Support	8.1	0.4	7.8	0.3
C	Spare Parts	9.0	0.2	8.4	0.2
D	Hardware Maintenance Overall	9.0	0.2	8.7	0.2

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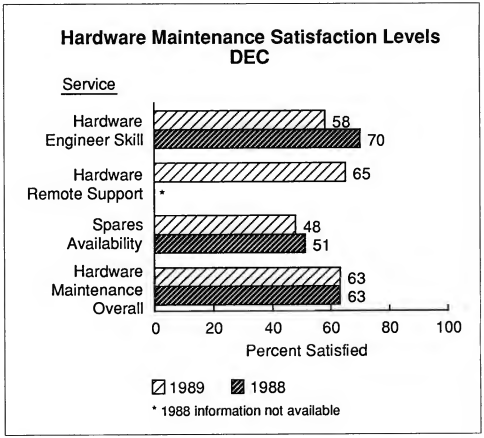
EXHIBIT IV-40



Eighty percent (32) of the DEC VAX 8XXX users surveyed reported receiving software support from DEC. Exhibits IV-41 and IV-42 present the mean requirements versus mean received ratings and software support satisfaction levels. All of the mean ratings received were lower than the mean ratings required by the DEC VAX 8XXX sample, with satisfaction levels ranging from 47% satisfied with software engineer skill to 71% satisfied with operational training received. Forty-eight percent of the DEC VAX 8XXX users reported being satisfied with overall software support received.

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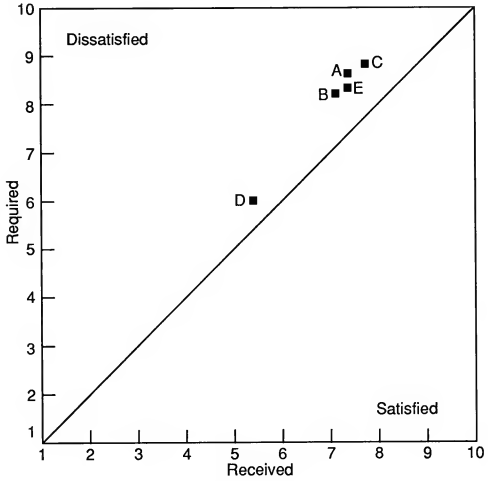
EXHIBIT IV-41

Software Support
Required versus Received
DEC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.6	0.3	7.3	0.3
B	Software Remote Support	8.2	0.5	7.1	0.4
C	Software Documentation	8.8	0.3	7.7	0.3
D	Operational Training	6.0	0.7	5.4	0.6
E	Software Support Overall	8.3	0.3	7.3	0.3

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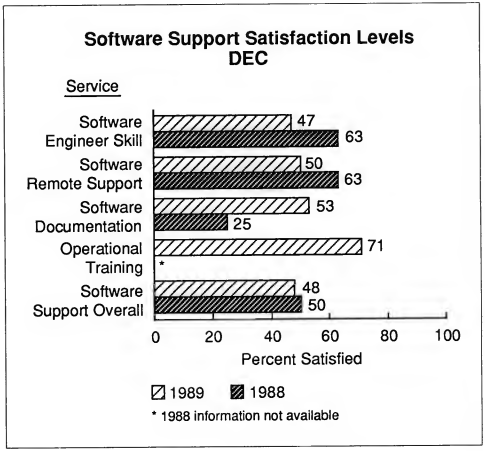
EXHIBIT IV-42



Ancillary services mean requirements versus mean services received and satisfaction levels are presented in Exhibits IV-43 and IV-44. Over 90% of the DEC VAX 8XXX sample reported receiving ancillary services from DEC. Even though the mean requirements for ancillary services were higher than the mean services received, a higher percent of users were satisfied with the services received than in the 1988 sample. Satisfaction levels ranged from 61% for services overall to 74% of the users satisfied with the installation/de-installation services received. The greatest increase in satisfaction level was seen in network design and planning services, where only 38% of the 1988 sample and 66% of the 1989 sample reported being satisfied with the services received.

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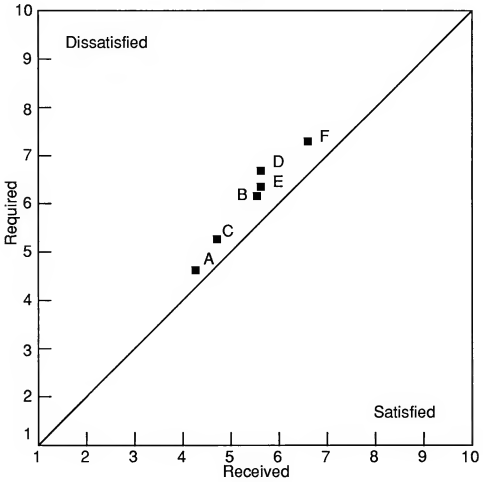
EXHIBIT IV-43

Ancillary Services
Required versus Received
DEC



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.6	0.7	4.3	0.6
B	Preinstallation Planning	6.1	0.6	5.5	0.5
C	Consulting	5.3	0.6	4.8	0.5
D	Installation/Deinstallation	6.8	0.5	6.6	0.5
E	Network Design/Planning	6.2	0.6	5.7	0.6
F	Ancillary Services Overall	7.3	0.4	6.7	0.4

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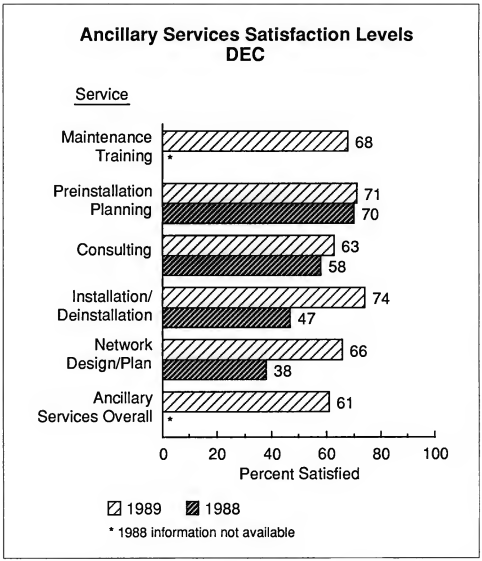
EXHIBIT IV-44



E

Hewlett-Packard 3000

The 1989 HP 3000 sample consisted of 40 users representing the discrete manufacturing, services, process manufacturing, education, banking/ finance, other industry-specific, wholesale distribution, retail distribution, telecommunication, and transportation industries.

An analysis of the service contract coverage reported by the HP sample is presented in Exhibit IV-45. The majority of the HP sample reported having prime-shift coverage (Monday through Friday, nine hours per day). While the same percent of the sample (64%) reported Monday-through-Friday coverage in 1988 and 1989, a higher percent of the 1989 sample elected the full seven-days-per-week coverage, rather than the six-day coverage.

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EXHIBIT IV-45

Contract Coverage
HP

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	64	64
Monday - Saturday	5	10
Monday - Sunday	31	26
Hours Covered		
1 - 9	50	36
10 - 16	17	28
17 - 24	33	36

A large drop in the reported system interruptions of the HP sample is shown in Exhibit IV-46. The 1988 sample reported average system interruptions per month of 1.4, while the 1989 sample reported a mean of 0.5 system interruptions per month. The causes for the interruptions were approximately the same as the previous year—users reported that 58% of the interruptions were hardware-based. A higher percent of the interruptions reported by the 1989 sample were due to other factors, and a lower percent were software-based.

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EXHIBIT IV-46

System Interruption Analysis
HP

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.5	0.1	1.4	0.5
Hardware-caused	58	7.0	64	5.9
System software-caused	15	4.6	10	3.0
Application software-caused	1	0.9	10	3.5
Other-caused	26	6.1	16	4.3

Exhibits IV-47 and IV-48 present the system availability performance analysis and satisfaction levels for availability, response time, and repair time. The 1989 sample's mean system availability requirement is lower than that of the 1988 sample (98.0), and the mean availability received is higher than the requirement, but still lower than that of the 1988 sample (97.1), yet the satisfaction level has increased only slightly over the 1988 level. It appears that even though the sample has lowered its system availability requirement, and a few respondents are getting very good availability, the overall satisfaction level of the sample with system availability has not risen to its former level of 83%, found in the 1987 sample.

The mean response time required and received has risen slightly for the 1989 HP sample from 1988, with the satisfaction level with response time staying about the same as in 1988. The 1989 HP sample is placing greater demands on Hewlett-Packard in terms of repair time requirements. The mean repair time required by the 1989 sample was 3.6 hours versus the 1988 sample mean of 5.7 hours. The mean repair time received has dropped from 4.4 hours for the 1988 sample to 1.9 hours reported by the 1989 sample, yet only 88% of the 1989 sample was satisfied with the repair time received from Hewlett-Packard, down from 96% in 1988.

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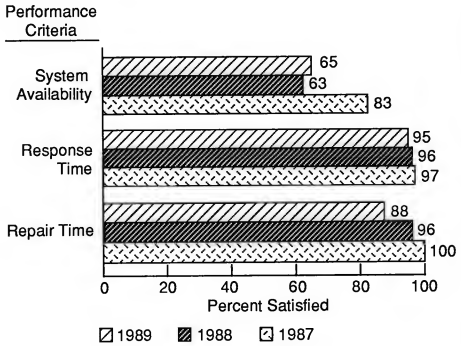
EXHIBIT IV-47

System Availability Performance Analysis
HP

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	96.3	1.1	96.9	0.8
Response time (Hours)	5.9	1.1	4.1	1.0
Repair time (Hours)	3.6	1.0	1.9	0.2

EXHIBIT IV-48

System Availability Performance Satisfaction
HP



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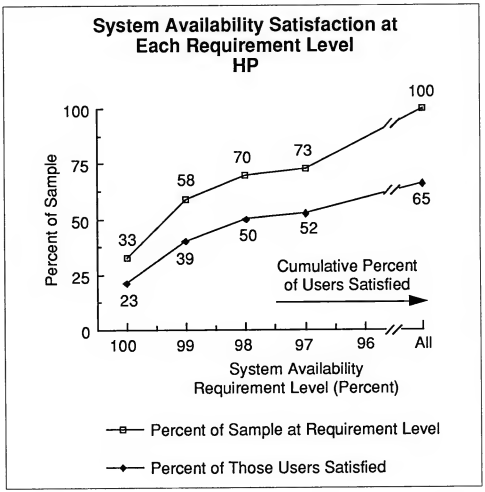
System availability satisfaction at each requirement level is presented in Exhibit IV-49 for the HP 3000 sample. One-third of the HP sample required 100% system availability, but only 23% received it. Twenty-seven percent of the sample required 75%-97% system availability; this served to lower the mean requirement, but did not add a great deal to the overall satisfaction levels, as 48% of the sample that required 97% or better availability did not receive it.

EXHIBIT IV-49



Hardware maintenance requirements and satisfaction levels are presented in Exhibits IV-50 and IV-51. A significant improvement was achieved in the area of spare parts, for the mean rating required was 8.6, the mean rating received was 8.7, and 76% of the HP users received spare parts availability meeting their requirements. This compares to 58% reported by the 1988 sample. The mean requirement of 8.9 for hardware engineer skill is slightly higher than the 8.6 mean rating received, but 74% of the HP users reported receiving engineer skill level at or above their requirement. Eighty-two percent of the HP sample was satisfied with the hardware maintenance received overall, even though the mean rating received was slightly lower than the requirement of 9.2.

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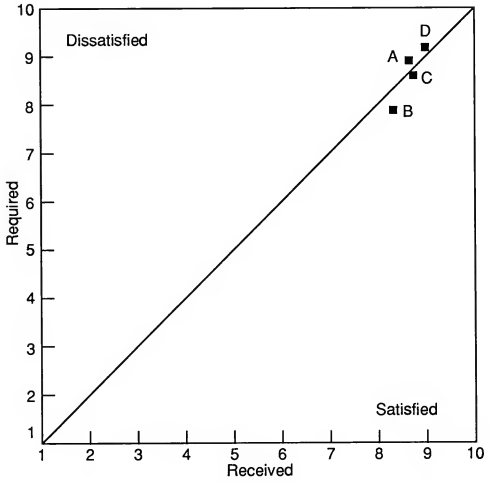
EXHIBIT IV-50

Hardware Maintenance
Required versus Received
HP



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.9	0.2	8.6	0.3
B	Hardware Remote Support	7.9	0.3	8.3	0.2
C	Spare Parts	8.6	0.2	8.7	0.2
D	Hardware Maintenance Overall	9.2	0.1	9.0	0.2

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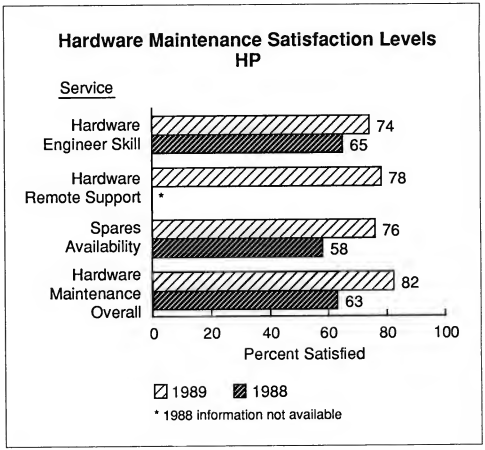
EXHIBIT IV-51



Sixty percent of the HP 3000 sample reported receiving software support from HP. Analyses of support required and received and satisfaction levels are shown in Exhibits IV-52 and IV-53. Mean requirements for the components of software support ranged from 6.7 to 8.4; mean ratings received ranged from 7.3 for operational training to 8.2 for remote support; and satisfaction levels were between 70% and 94%. Operational training had a mean requirement of 6.7, a mean rating received of 7.3, with the highest satisfaction rating—94%—of the users receiving services at or above their requirement. Eighty-one percent of the HP sample reported receiving satisfactory software support services overall.

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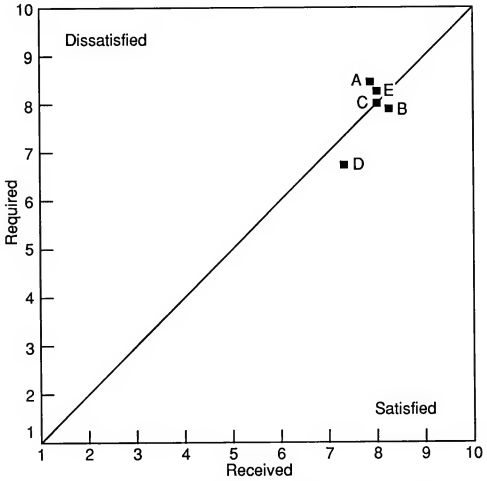
EXHIBIT IV-52

Software Support
Required versus Received
HP



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.4	0.4	7.9	0.3
B	Software Remote Support	7.9	0.5	8.2	0.3
C	Software Documentation	8.0	0.4	8.0	0.3
D	Operational Training	6.7	0.4	7.3	0.5
E	Software Support Overall	8.2	0.2	8.0	0.2

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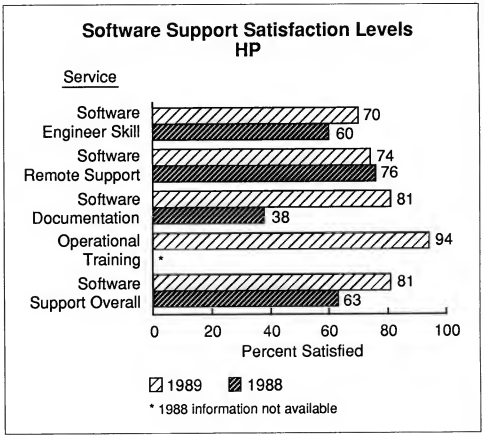
EXHIBIT IV-53



Eighty percent of the HP sample reported receiving ancillary services from Hewlett-Packard. Exhibits IV-54 and IV-55 present an analysis of services required versus received, and satisfaction levels received. Maintenance training had the lowest mean rating required and received, with 67% of the sample receiving maintenance training meeting their requirements. Satisfaction levels of the 1989 sample were up from those of the 1988 sample for the components studied in both years, with 84% of the HP sample being satisfied with the overall ancillary services they received.

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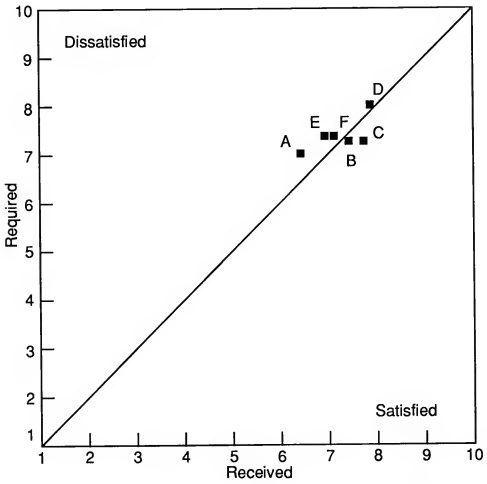
EXHIBIT IV-54

Ancillary Services Required versus Received HP



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	7.0	0.6	6.4	0.7
B	Preinstallation Planning	7.3	0.4	7.4	0.4
C	Consulting	7.3	0.5	7.7	0.4
D	Installation/Deinstallation	8.0	0.4	7.9	0.4
E	Network Design/Planning	7.4	0.4	7.1	0.5
F	Ancillary Services Overall	7.4	0.3	7.2	0.3

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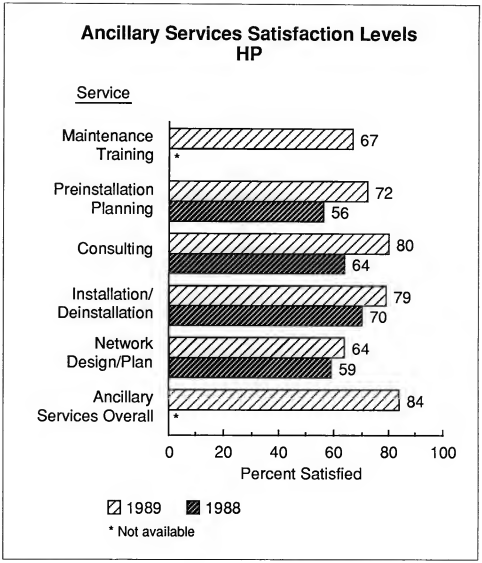
EXHIBIT IV-55



F

IBM 937X

The 1989 sample of IBM 937X users represented the services, discrete manufacturing, process manufacturing, education, banking/finance, medical, state and local government, wholesale distribution, retail distribution, and telecommunications industries. INPUT began analyzing this product in 1988 as part of the midrange systems report.

Exhibit IV-56 presents the contract coverage of the IBM 937X sample. IBM now offers around-the-clock, seven-day-per-week coverage as its standard, but some of the respondents were apparently unaware that they had this coverage from IBM.

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EXHIBIT IV-56

Contract Coverage
IBM 937X

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	20	25
Monday - Saturday	2	0
Monday - Sunday	78	75
Hours Covered		
1 - 9	25	15
10 - 16	0	5
17 - 24	75	80

Exhibit IV-57 analyzes system interruptions per month as reported by the sample. The mean number of system interruptions per month dropped from 1.6 reported by the 1988 sample, to 0.7 reported by the 1989 sample. A higher percentage of interruptions were reported in 1989 as being hardware-based as opposed to software-based.

IBM 937X users are reporting higher mean system availability and satisfaction levels with system availability, as is seen in Exhibits IV-58 and IV-59. The 1989 sample reported mean system availability received of 97.5%, while requiring a mean of 97.3%, with 74% (up from 45% in 1988) of users satisfied with the system availability they receive.

A small increase in response time satisfaction was also seen in the 1989 sample, increasing from 86% in 1988 to 89% in 1989. On the other hand, repair time satisfaction had a small drop, from 96% of the users being satisfied with repair time in 1988 to 93% being satisfied in 1989.

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EXHIBIT IV-57

System Interruption Analysis
IBM 937X

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.7	0.2	1.6	0.4
Hardware-caused	57	2.5	36	6.4
System software-caused	22	5.4	27	5.8
Application software-caused	3	1.8	16	4.8
Other-caused	18	6.2	21	5.8

EXHIBIT IV-58

System Availability Performance Analysis
IBM 937X

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	97.3	0.7	97.5	0.6
Response time (Hours)	2.2	0.2	1.7	0.2
Repair time (Hours)	2.7	0.5	2.9	0.9

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EXHIBIT IV-59

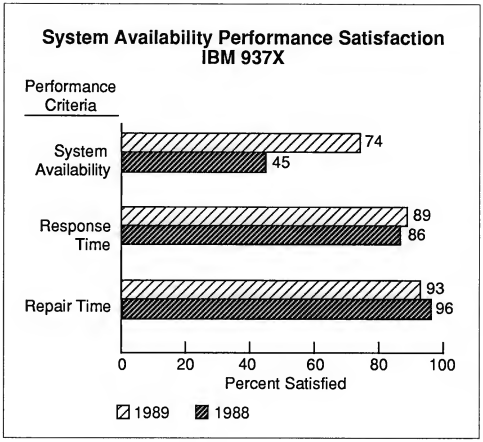

Exhibit IV-60 presents the system availability satisfaction at each requirement level for the IBM 937X user sample. Fifty percent of the users required 99.5% or greater system availability, with 71% receiving the required system availability. Overall, 73% of the IBM 937X users received the system availability required. This compares to only 56% in the overall sample.

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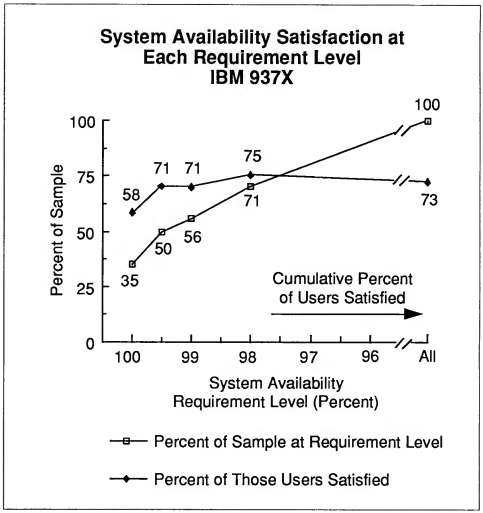
EXHIBIT IV-60



The mean hardware requirements versus the services received do not appear to substantiate the high satisfaction levels with system availability, response time and repair time. Exhibits IV-61 and IV-62 present the mean requirement versus ratings of hardware maintenance received, and hardware satisfaction levels for the IBM 937X sample. The users reported high mean requirements for the traditional elements of hardware maintenance, ranging from 8.0 for remote support to 9.1 for spare parts. The mean ratings for hardware maintenance received ranged from 7.2 for remote support to 8.2 for spare parts, with hardware maintenance overall receiving a mean rating of 8.3, versus 8.9 required. Satisfaction levels echoed the unmet requirements, ranging from 51% of the users satisfied with engineer skill to 58% of the users being satisfied with the overall hardware maintenance received. Fifty-six percent of the users were satisfied with the spare parts availability received from IBM.

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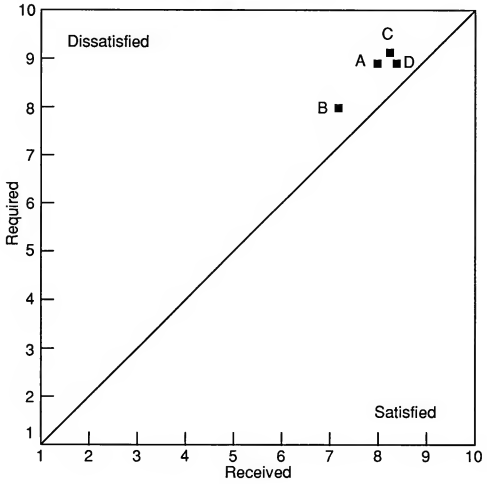
EXHIBIT IV-61

Hardware Maintenance
Required versus Received
IBM 937X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.9	0.2	8.0	0.2
B	Hardware Remote Support	8.0	0.6	7.2	0.5
C	Spare Parts	9.1	0.2	8.2	0.2
D	Hardware Maintenance Overall	8.9	0.2	8.3	0.2

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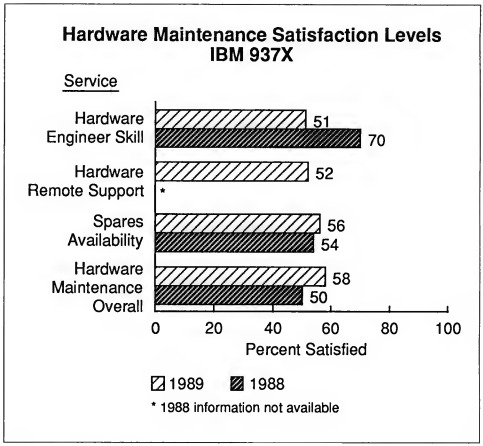
EXHIBIT IV-62



Eighty percent of the IBM 937X users reported receiving software support services. The mean ratings required and received, and satisfaction levels are presented in Exhibits IV-63 and IV-64. The low satisfaction levels achieved are supported by the high mean ratings required by the sample versus the low mean ratings of the software services received by the sample. There appears to be a requirement for software services, as reported by the IBM 937X sample, that is currently not being satisfied by IBM.

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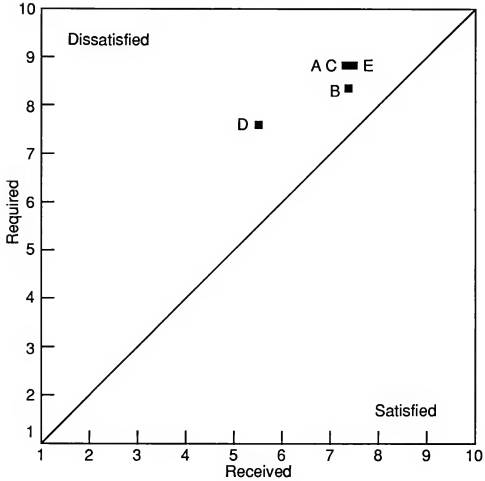
EXHIBIT IV-63

Software Support Required versus Received IBM 937X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.8	0.3	7.3	0.3
B	Software Remote Support	8.3	0.6	7.3	0.4
C	Software Documentation	8.8	0.3	7.3	0.3
D	Operational Training	7.6	0.6	5.5	0.5
E	Software Support Overall	8.8	0.2	7.4	0.3

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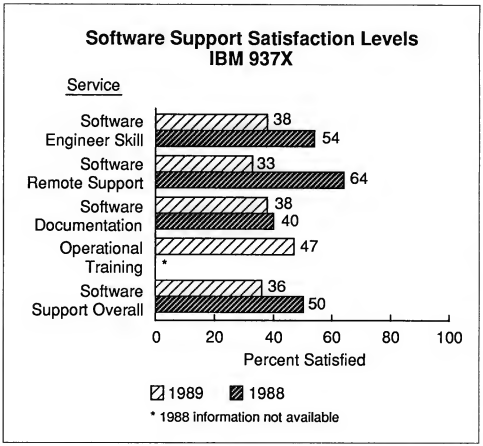
EXHIBIT IV-64



Mean ratings for ancillary services and satisfaction levels are presented in Exhibits IV-65 and IV-66. Mean ratings for services required ranged from 6.1 for maintenance training to 9.0 for installation/deinstallation services, with ancillary services overall having a mean requirement rating of 8.6. The mean ratings of services received ranged from 4.6 for maintenance training to 7.6 for installation/deinstallation services, with ancillary services overall receiving a 6.8. The users reported lower satisfaction levels with ancillary services than those reported by the 1988 sample, with 40% of the 1989 IBM 937X users being satisfied with the ancillary services received overall.

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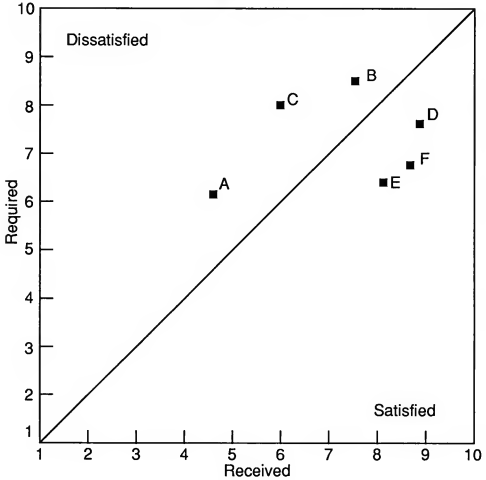
EXHIBIT IV-65

Ancillary Services
Required versus Received
IBM 937X



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.1	0.8	4.6	0.6
B	Preinstallation Planning	8.5	0.3	7.5	0.3
C	Consulting	8.0	0.4	6.0	0.4
D	Installation/Deinstallation	9.0	0.2	7.6	0.3
E	Network Design/Planning	8.1	0.6	6.4	0.6
F	Ancillary Services Overall	8.6	0.3	6.8	0.4

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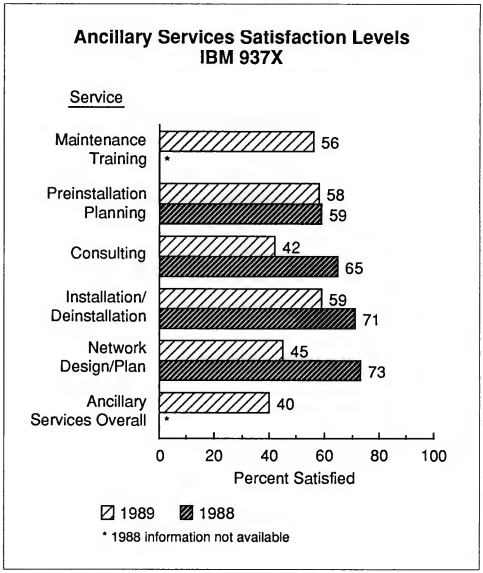
EXHIBIT IV-66



G

IBM AS/400

The 1989 INPUT AS/400 sample consisted of 40 users, representing the discrete manufacturing, process manufacturing, wholesale distribution, retail distribution, medical, transportation, utilities, telecommunications, and services industries. Since this is the first year INPUT has included IBM AS/400 users in its midrange systems report, the historical comparative tables are not available. Comparison to the overall midrange system sample will be made wherever possible.

Exhibit IV-67 presents the contractual service coverage of the IBM sample. The majority of users reported around-the-clock coverage, seven days per week, with only 23% reporting Monday-through-Friday coverage and 20% prime-shift (nine hours per day) coverage. This indicates

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that some IBM users are still not aware that IBM now provides 24-hour, seven-day-per-week coverage under all service contracts.

EXHIBIT IV-67

Contract Coverage
IBM AS/400

Coverage	Percent of Sample 1989
Days Covered	
Monday - Friday	23
Monday - Saturday	0
Monday - Sunday	77
Hours Covered	
1 - 9	20
10 - 16	5
17 - 24	75

System interruptions are analyzed in Exhibit IV-68. The AS/400 sample showed mean system interruptions per month of 0.6, with 68% of the interruptions being hardware-based. Since the AS/400 is fairly new on the market, it is expected that there will be a stabilizing of hardware problems which cause interruptions. A fairly high percent of the interruptions were reported as being system software-caused, suggesting that some bugs still exist in the system software.

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EXHIBIT IV-68

System Interruption Analysis
IBM AS/400

	1989	
	Mean	SE
System interruptions per month per machine	0.6	0.2
Hardware-caused	68	7.5
System software-caused	18	6.1
Application software-caused	2	1.5
Other-caused	12	4.9

System availability performance and satisfaction levels are shown in Exhibits IV-69 and IV-70. IBM exceeded the requirements in the areas of system availability, response time and repair time. The AS/400 sample reported a mean system availability requirement of 95.9% and a mean availability received of 98.0%, with 67% of users being satisfied with the system availability received. The mean response time required of 1.7 hours was beat by a response time received of 1.6 hours, with 89% of the users receiving better response time than required. The repair time was also exceeded by a slim margin (2.9 hours required, 2.7 hours received), but a very high percent of users (94%) received satisfactory repair time.

EXHIBIT IV-69

System Availability Performance Analysis
IBM AS/400

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	95.9	1.3	98.0	0.5
Response time (Hours)	1.7	0.1	1.6	0.2
Repair time (Hours)	2.9	0.7	2.7	0.7

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EXHIBIT IV-70

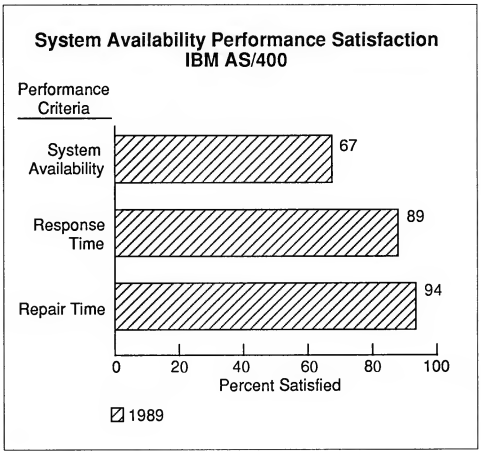

Exhibit IV-71 shows the distribution of system availability requirements and the percent of users satisfied at each requirement level. Sixty-one percent of the AS/400 users reported a system availability requirement of 100%. Only forty percent of those users reported receiving 100% system availability. Seventy-nine percent of the users require system availability of 98% or higher, and IBM manages to satisfy half of those users.

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EXHIBIT IV-71

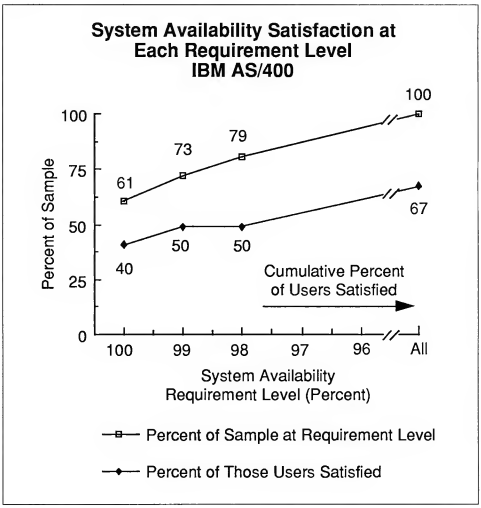

Exhibit IV-72 presents an analysis of hardware maintenance required versus received for the four items of traditional hardware maintenance. The AS/400 fell short in all four areas of hardware maintenance, as was also seen in the overall sample. Hardware remote support had the largest difference between the rating required (8.8) and the mean rating of service received (8.2), but had the highest satisfaction level of 74%, shown in Exhibit IV-73. All of the satisfaction levels were higher than those seen in the overall sample for the same criteria, with 64% of the AS/400 sample being satisfied with overall hardware maintenance compared to 59% of the overall sample.

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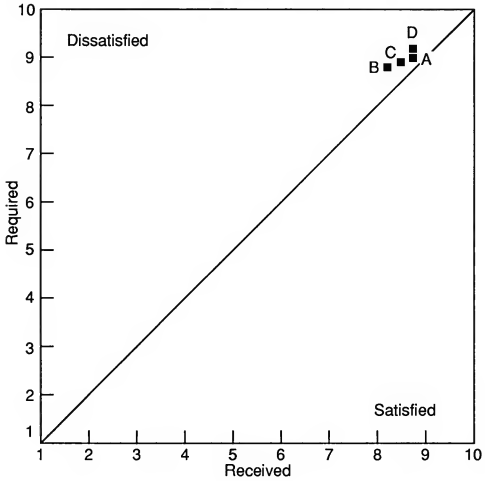
EXHIBIT IV-72

Hardware Maintenance
Required versus Received
IBM AS/400



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.0	0.2	8.7	0.2
B	Hardware Remote Support	8.8	0.2	8.2	0.2
C	Spare Parts	8.9	0.2	8.5	0.2
D	Hardware Maintenance Overall	9.1	0.2	8.7	0.2

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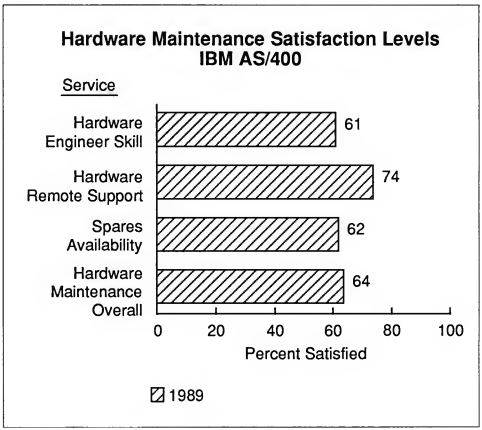
EXHIBIT IV-73



Ninety percent of the AS/400 sample reported receiving software support from their CPU manufacturer. Exhibits IV-74 and IV-75 present an analysis of required software support versus received software support and software support satisfaction levels. The mean ratings of service received were lower than the requirements in all five areas examined. Software engineer skill had the lowest satisfaction level, with 45% of the users being satisfied. Operational training, at 62%, had the highest satisfaction level.

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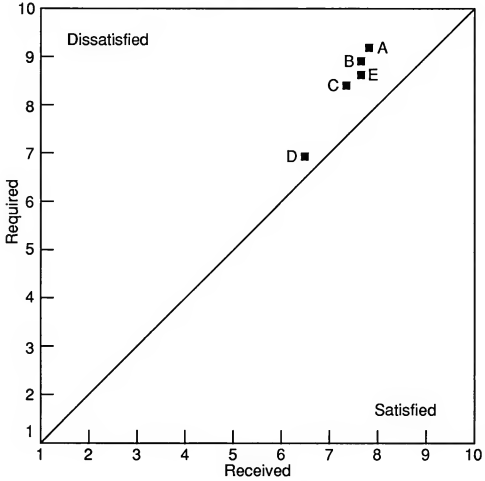
EXHIBIT IV-74

Software Support
Required versus Received
IBM AS/400



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	9.2	0.2	7.8	0.3
B	Software Remote Support	8.9	0.2	7.7	0.3
C	Software Documentation	8.4	0.2	7.3	0.3
D	Operational Training	6.9	0.5	6.5	0.4
E	Software Support Overall	8.6	0.2	7.7	0.3

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EXHIBIT IV-75

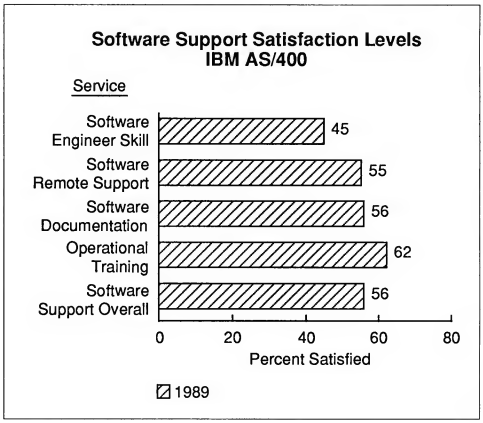

Exhibit IV-76 presents the requirements for ancillary services and evaluates IBM's performance in these areas. The mean ratings required ranged from 5.7 for maintenance training to 8.4 for preinstallation planning. The mean ratings for services received ranged from 5.5 for maintenance training to 7.8 for preinstallation planning. Satisfaction levels shown in Exhibit IV-77 show higher satisfaction levels for maintenance training and consulting than those of the overall sample. AS/400 satisfaction levels ranged from 59% to 77% for the six ancillary services areas. This compares to a range of 60% to 70% for the overall sample.

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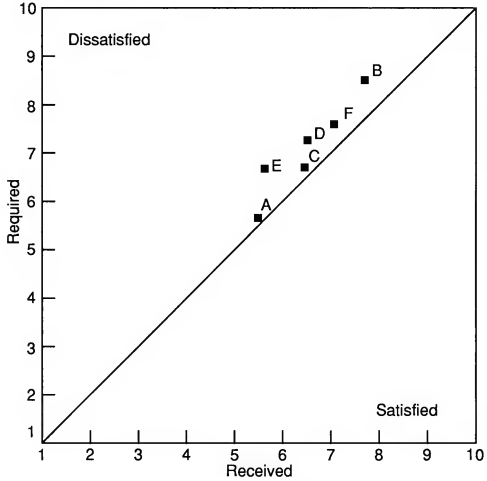
EXHIBIT IV-76

Ancillary Services
Required versus Received
IBM AS/400



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	5.7	0.7	5.5	0.7
B	Preinstallation Planning	8.4	0.4	7.8	0.4
C	Consulting	6.8	0.4	6.5	0.4
D	Installation/Deinstallation	7.2	0.5	6.5	0.6
E	Network Design/Planning	6.8	0.7	5.6	0.7
F	Ancillary Services Overall	7.5	0.4	7.1	0.4

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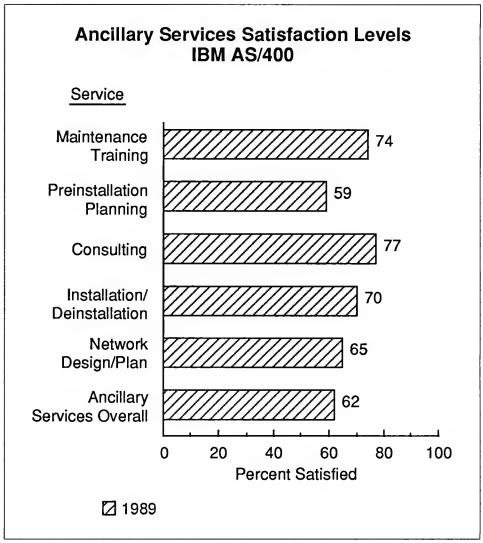
EXHIBIT IV-77



H

Prime

In 1989, INPUT interviewed 40 users of Prime 9X5X midrange systems. The user sample represented the discrete manufacturing, services, process manufacturing, insurance, education, retail distribution, state and local government, federal government, medical, utilities, and other industries.

Exhibit IV-78 provides contract coverage information on the Prime sample. Similar to the 1988 sample, 75% of the users had Monday-through-Friday coverage, with 50% opting for one-shift coverage and the other half choosing two or more shifts of coverage.

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EXHIBIT IV-78

Contract Coverage
Prime

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	75	75
Monday - Saturday	0	3
Monday - Sunday	25	12
Hours Covered		
1 - 9	50	46
10 - 16	40	38
17 - 24	10	16

The Prime sample averaged 0.9 system interruptions per month, as shown in Exhibit IV-79. This number is higher than the overall sample (0.6), yet is consistent with the mean system interruptions reported in 1988. A higher percent of interruptions were caused by hardware and system software problems in 1989, and a much lower percent were caused by other factors.

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EXHIBIT IV-79

System Interruption Analysis
Prime

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.9	0.2	0.9	0.2
Hardware-caused	66	5.5	59	8.0
System software-caused	13	3.7	9	3.3
Application software-caused	3	1.4	3	2.2
Other-caused	18	5.0	29	8.2

Exhibits IV-80 and IV-81 present an analysis of system availability performance and satisfaction levels as reported by the Prime sample. The mean system availability requirement was higher in 1989 than the requirement reported in the 1988 sample, with matching higher mean system availability received and higher system availability satisfaction. Even though the mean response time required was substantially higher than the mean response time received, 83% of the Prime sample reported being satisfied with the response time received.

EXHIBIT IV-80

System Availability Performance Analysis
Prime

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	97.1	0.5	97.4	0.4
Response time (Hours)	3.2	0.6	2.2	0.4
Repair time (Hours)	2.8	0.5	2.9	0.6

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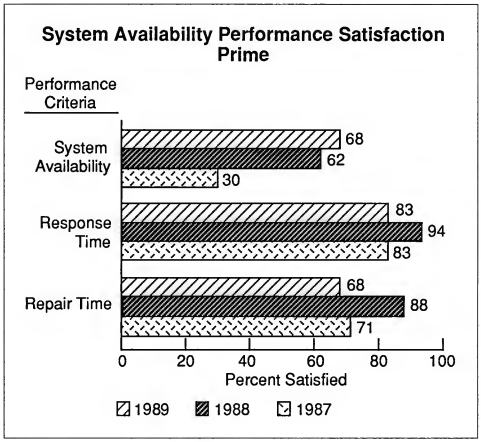
EXHIBIT IV-81



Prime users demand a fast repair time when the FE arrives, illustrated by the mean repair time requirement of 2.8 hours. This compares to the requirement from the total sample of 4.7 hours. Prime users reported a mean repair time received of 2.9, with only 68% of the users receiving satisfactory repair time.

Exhibit IV-82 presents the system availability satisfaction at each requirement level. Thirty percent of the Prime sample stated a requirement for 100% system availability, and 33% of those users received 100% availability.

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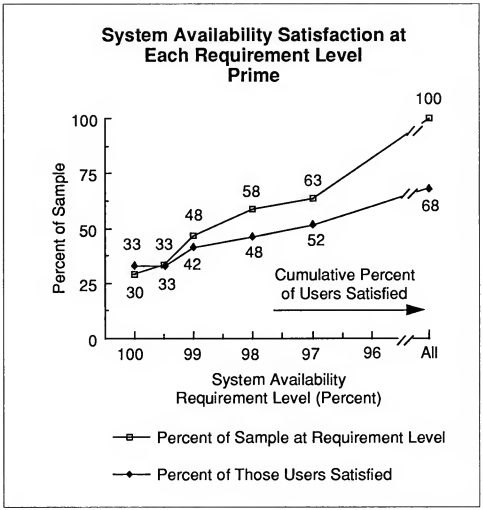
EXHIBIT IV-82



Exhibits IV-83 and IV-84 present an analysis of hardware maintenance requirements and services received and hardware maintenance satisfaction levels. Mean ratings reported of services required were higher than mean ratings received in all of the areas of hardware maintenance examined. Satisfaction levels were slightly below those of the overall sample, but spares availability showed a significant improvement over last year. The satisfaction level for hardware engineer skill dropped from 55% of users being satisfied in 1988 to 49% of users satisfied in 1989.

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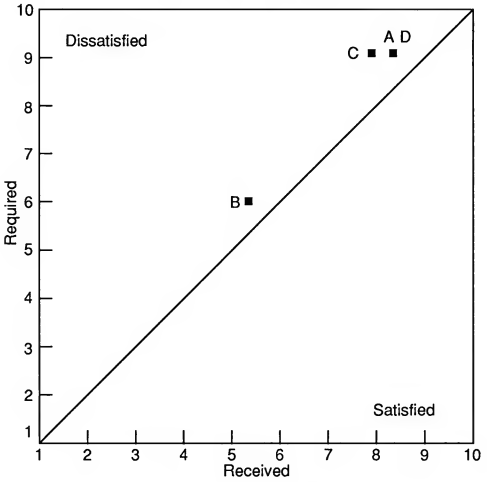
EXHIBIT IV-83

Hardware Maintenance
Required versus Received
Prime



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.1	0.2	8.3	0.2
B	Hardware Remote Support	6.0	0.6	5.3	0.6
C	Spare Parts	9.1	0.2	7.9	0.3
D	Hardware Maintenance Overall	9.1	0.2	8.3	0.3

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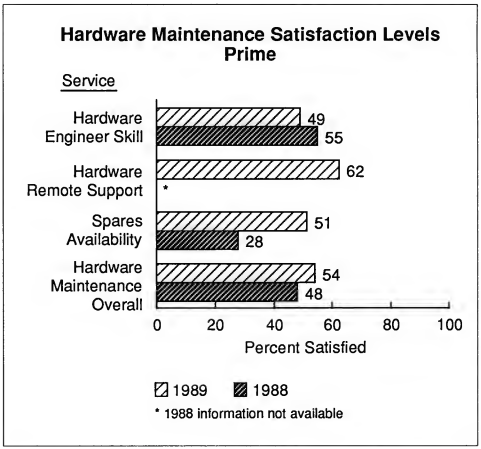
EXHIBIT IV-84



Ninety-three percent of the Prime sample received software support from Prime. Exhibits IV-85 and IV-86 present the software support mean ratings of requirements and services received and satisfaction levels with services received. The Prime sample had lower satisfaction levels for software engineer skill and remote support than the overall sample. Satisfaction levels for operational training and software support overall were higher for the Prime sample than the overall sample. Software support overall improved from 45% satisfied in 1988 to 59% in 1989.

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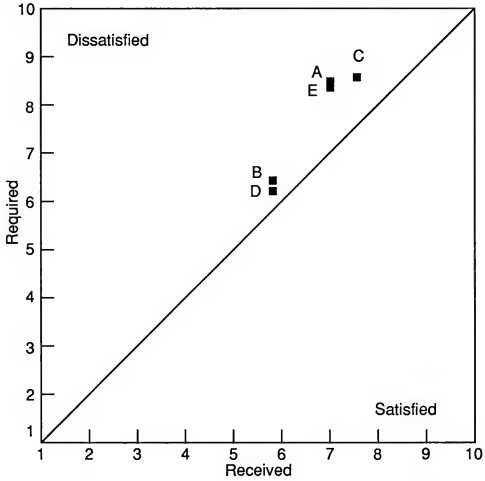
EXHIBIT IV-85

Software Support Required versus Received Prime



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.4	0.3	7.0	0.4
B	Software Remote Support	6.4	0.6	5.8	0.5
C	Software Documentation	8.5	0.2	7.6	0.3
D	Operational Training	6.2	0.6	5.8	0.6
E	Software Support Overall	8.3	0.3	7.0	0.3

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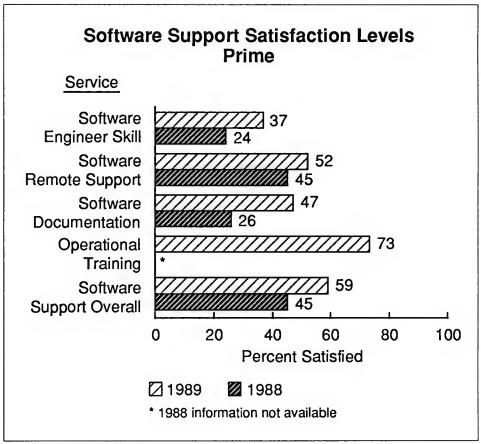
EXHIBIT IV-86



User requirements for ancillary services and mean ratings of services received are presented in Exhibit IV-87 for the Prime sample. Mean ratings for consulting and installation/ deinstallation services received were higher than the requirements, and 88% and 97%, respectively, of the users were satisfied with these services. Satisfaction levels of the Prime sample ranged from 73% to 97% for ancillary services (Exhibit IV-88) and were much higher than those reported in 1988 or those shown in the overall sample.

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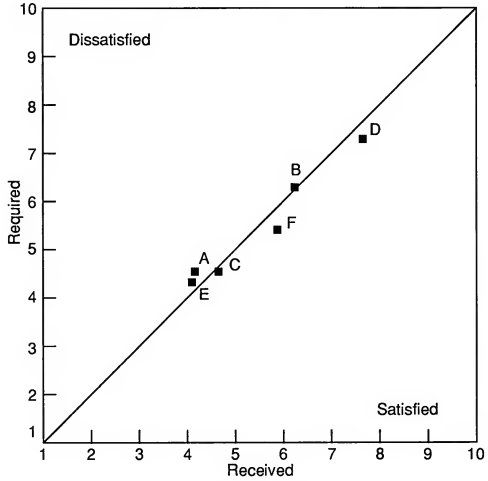
EXHIBIT IV-87

Ancillary Services
Required versus Received
Prime



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.5	0.5	4.2	0.5
B	Preinstallation Planning	6.2	0.6	6.2	0.6
C	Consulting	4.6	0.6	4.7	0.6
D	Installation/Deinstallation	7.3	0.4	7.7	0.4
E	Network Design/Planning	4.3	0.7	4.1	0.6
F	Ancillary Services Overall	5.4	0.4	5.9	0.5

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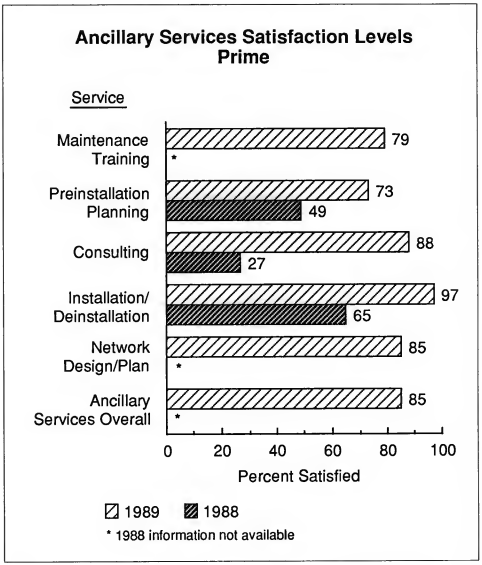
EXHIBIT IV-88



I

Tandem

The 1989 Tandem sample consists of 40 users of Tandem NONSTOP, TXP, and VLX systems. The users interviewed represent the service, process manufacturing, wholesale distribution, retail distribution, banking/finance, medical, federal government, insurance, transportation, and education industries. Since Tandem was not examined in 1988, historical comparisons will be limited. Comparisons to 1987 information and the overall sample will be made whenever possible.

Contract coverage for the Tandem sample is presented in Exhibit IV-89. The majority of users reported Monday through Friday, one shift coverage of their Tandem system. The breakdown of coverage is very close to that shown in the overall sample, with the exception that 6% more of the Tandem sample reported round-the-clock service than did the overall sample.

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EXHIBIT IV-89

Contract Coverage
Tandem

Coverage	Percent of Sample 1989
Days Covered	
Monday - Friday	60
Monday - Saturday	5
Monday - Sunday	35
Hours Covered	
1 - 9	53
10 - 16	10
17 - 24	37

System interruptions are analyzed in Exhibit IV-90. The Tandem sample reported fewer interruptions per month than the overall sample, with a greater part of the Tandem sample reporting system interruptions due to other causes than was reported in the overall sample.

System availability appears to be a problem with the Tandem sample, as indicated by the availability requirement shown in Exhibit IV-91. The Tandem sample reported a very high mean system availability requirement of 99.8%, with an average availability received of 99.0%. Exhibit IV-92 shows 43% of the Tandem sample being satisfied with system availability received in 1989, while 89% of the 1987 sample reported being satisfied with availability. INPUT did not survey Tandem users in 1988.

Response time and repair time fared much better in 1989 with the mean times received being lower than the requirements. The Tandem sample reported 100% satisfaction with response time (versus 96% in 1987) and 97% satisfaction with repair time (92% in 1987).

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EXHIBIT IV-90

System Interruption Analysis
Tandem

	1989	
	Mean	SE
System interruptions per month per machine	0.4	0.1
Hardware-caused	63	9.6
System software-caused	5	4.4
Application software-caused	1	0.1
Other-caused	31	9.3

EXHIBIT IV-91

System Availability Performance Analysis
Tandem

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	99.8	0.1	99.0	0.2
Response time (Hours)	2.6	0.6	1.6	0.3
Repair time (Hours)	3.7	0.7	2.8	0.5

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EXHIBIT IV-92

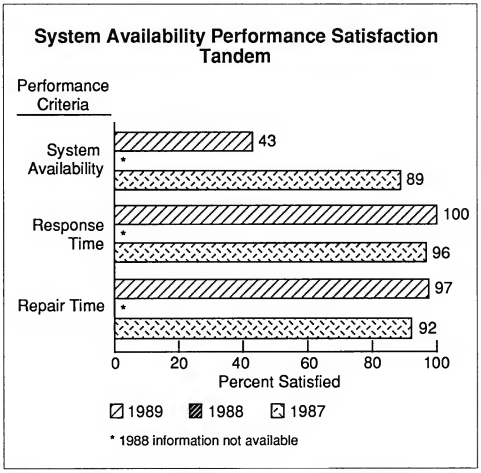

Exhibit IV-93 gives a strong indication of why the satisfaction level is low for the Tandem sample. Eighty-three percent of the users reported a system availability requirement of 100%, but only 39% of those users were satisfied with the availability received. Ninety-five percent of the Tandem sample required 99% or greater availability; 42% were satisfied. Only one of the two users requiring less than 99% availability received satisfactory availability.

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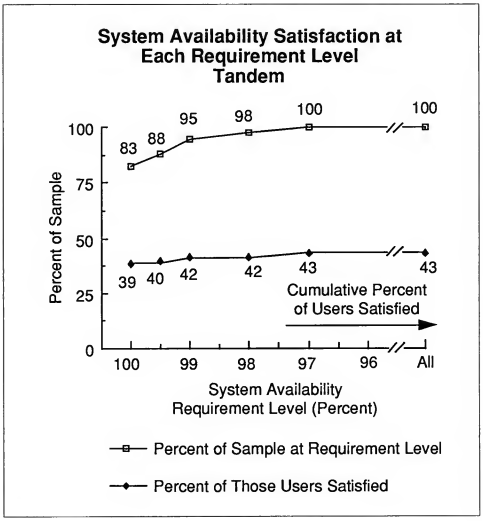
EXHIBIT IV-93



Mean ratings received were much lower than requirements for all areas of hardware maintenance, as shown in Exhibit IV-94. The mean ratings received were in line with those of the overall sample, but the requirements were much higher for the Tandem users. Hardware maintenance satisfaction levels (Exhibit IV-95) ranged from 28% to 50%, with 40% of the users being satisfied with hardware maintenance overall. Hardware engineer skill was a problem—only 28% of the users were satisfied.

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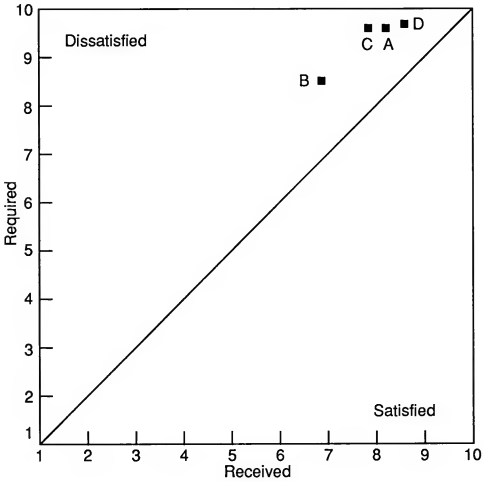
EXHIBIT IV-94

Hardware Maintenance
Required versus Received
Tandem



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.6	0.1	8.2	0.2
B	Hardware Remote Support	8.5	0.4	6.9	0.4
C	Spare Parts	9.6	0.1	7.9	0.3
D	Hardware Maintenance Overall	9.7	0.1	8.6	0.2

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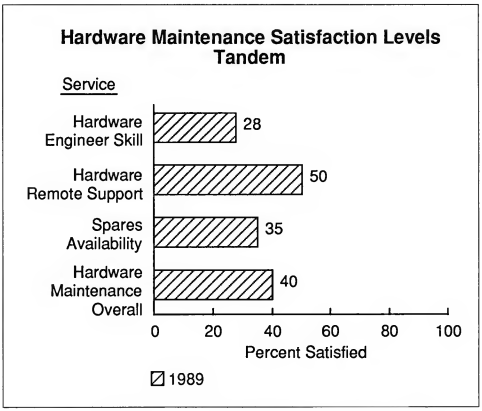
EXHIBIT IV-95



Sixty-three percent of the sample reported receiving software support from Tandem. Exhibits IV-96 and IV-97 present the software support requirements versus services received and satisfaction levels reported by the respondents. Once again, the Tandem sample reported higher mean requirements than the overall sample in software support areas. The mean ratings of service received were higher than those of the overall sample, but did not meet the requirements. Therefore, satisfaction levels were very low for software support, ranging from 23% for software documentation to 50% for software remote support. Thirty-nine percent of the overall sample reported receiving satisfactory overall software support. This compares to 51% of the total sample that was satisfied with software support.

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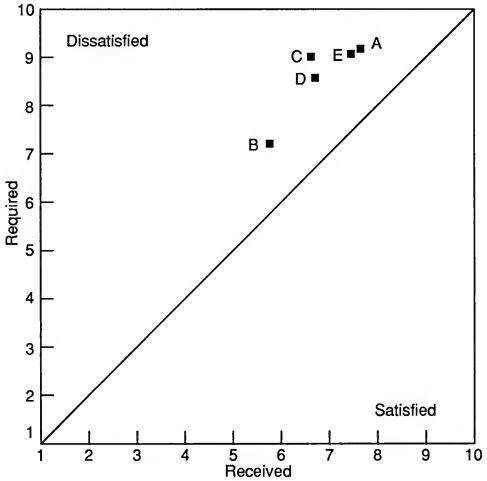
EXHIBIT IV-96

Software Support
Required versus Received
Tandem



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	9.2	0.3	7.7	0.3
B	Software Remote Support	7.2	0.9	5.7	0.7
C	Software Documentation	9.0	0.4	6.6	0.5
D	Operational Training	8.6	0.5	6.7	0.6
E	Software Support Overall	9.1	0.3	7.5	0.3

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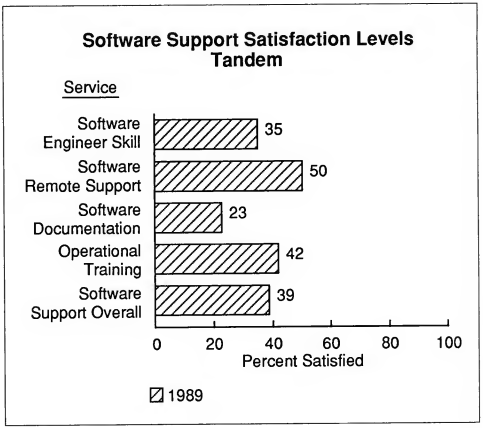
EXHIBIT IV-97



The same pattern carried through into the ancillary services areas, as shown in Exhibit IV-98. The Tandem sample reported higher mean ratings for services required than the overall sample and reported higher mean ratings received, but the ratings received did not come close to the requirements. The satisfaction levels presented in Exhibit IV-99 show the need for improvements in ancillary services to bring the satisfaction levels up from a range of 42% to 60% to at least the range of the total sample (60% to 70%).

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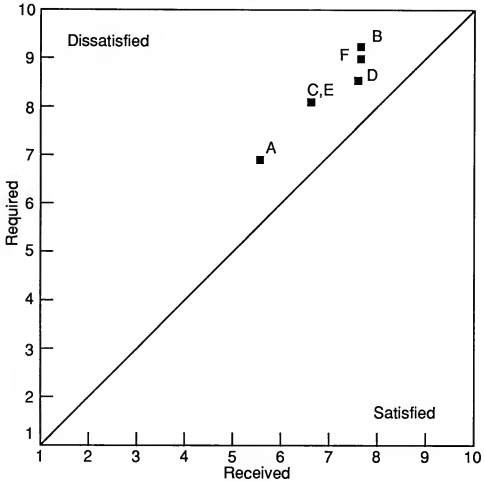
EXHIBIT IV-98

Ancillary Services
Required versus Received
Tandem



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.9	0.7	5.5	0.6
B	Preinstallation Planning	9.2	0.3	7.6	0.5
C	Consulting	8.1	0.6	6.6	0.6
D	Installation/Deinstallation	8.6	0.4	7.6	0.4
E	Network Design/Planning	8.1	0.6	6.6	0.6
F	Ancillary Services Overall	9.0	0.3	7.6	0.3

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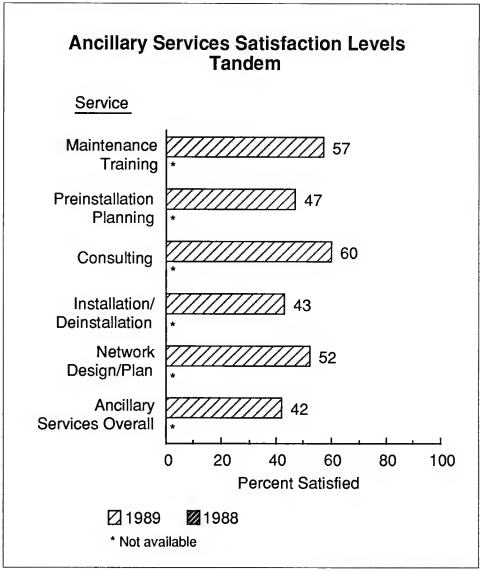
EXHIBIT IV-99



J

Wang VS

In 1989, INPUT interviewed 40 users of Wang VS midrange systems. This sample represented the services, process manufacturing, federal government, retail distribution, state and local government, discrete manufacturing, wholesale distribution, banking/finance, and medical industries.

Exhibit IV-100 presents the contract coverage reported by the Wang sample. Ninety-five percent of the sample reported receiving five-days-per-week coverage, with 90% electing one-shift coverage, an increase from last year's 81% one-shift coverage.

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EXHIBIT IV-100

Contract Coverage
Wang

Coverage	Percent of Sample 1989	1988
Days Covered		
Monday - Friday	95	94
Monday - Saturday	0	3
Monday - Sunday	5	3
Hours Covered		
1 - 9	90	81
10 - 16	3	13
17 - 24	7	6

A significant reduction in the mean number of system interruptions reported per month is shown in Exhibit IV-101. The mean number of interruptions for the Wang sample dropped to 0.5 per month, from 1.9 in 1988. The reported causes for the interruptions are about the same as in 1988. The 1989 sample reported fewer system software-caused interruptions and more other-caused interruptions.

Exhibit IV-102 displays requirements and service received levels for systems availability, response time, and repair time. Wang failed to meet the mean requirements for all three of these items. There has been an improvement in the availability provided, as shown by the increase in mean availability received (from 95.5% in 1988 to 98.7% in 1989). This improvement, however, did not result in an increase in the percentage of users satisfied (Exhibit IV-103). This percent dropped from 31% satisfied in 1988 to 18% in 1989.

Even though the system availability satisfaction level has seen a large drop, the response time and repair time satisfaction levels have increased from 1988. Response time satisfaction increased from 75% in 1988 to 92% in 1989. Repair time satisfaction rose from 81% in 1988 to 97% in 1989.

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EXHIBIT IV-101

System Interruption Analysis
Wang

	1989		1988	
	Mean	SE	Mean	SE
System interruptions per month per machine	0.5	0.2	1.9	0.4
Hardware-caused	65	6.8	65	5.9
System software-caused	9	3.4	18	4.0
Application software-caused	3	1.1	5	1.8
Other-caused	23	6.2	12	4.9

EXHIBIT IV-102

System Availability Performance Analysis
Wang

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System availability (Percent)	98.7	0.0	98.7	2.1
Response time (Hours)	2.9	0.3	1.9	0.3
Repair time (Hours)	2.9	0.3	1.6	0.2

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EXHIBIT IV-103

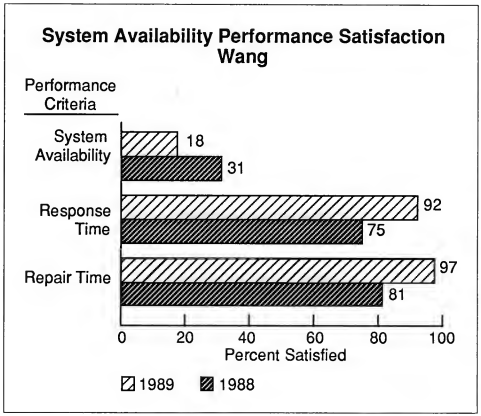

Exhibit IV-104 presents the distribution of system availability requirements by requirement level and the percent of users satisfied at each requirement level. Eighty-seven percent of Wang users require a system availability of 99.5% or higher, but only 9% of these users are receiving what they require.

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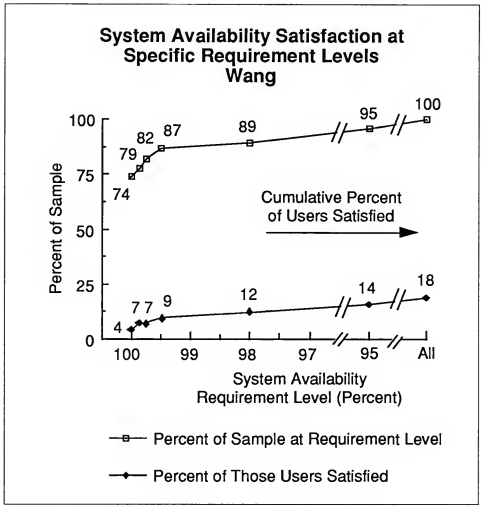
EXHIBIT IV-104



Exhibits IV-105 and IV-106 provide an analysis of hardware maintenance required versus received, and hardware maintenance levels for the Wang sample. The high requirement of the sample for hardware maintenance areas relates to the high requirement for system availability. Mean requirements ranged from 8.5 for hardware remote support to 10.0 for hardware maintenance overall. Hardware maintenance ratings received were not low, ranging from 7.1 to 8.4, yet they were not high enough to satisfy the Wang users. Satisfaction levels for hardware maintenance areas ranged from 13% to 32%, with 13% of the users receiving satisfactory overall hardware maintenance. This compares to 59% in the total sample.

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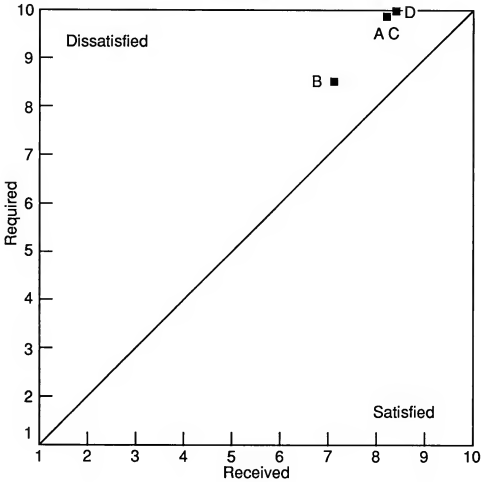
EXHIBIT IV-105

Hardware Maintenance
Required versus Received
Wang



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.9	0.1	8.2	0.2
B	Hardware Remote Support	8.5	0.6	7.1	0.6
C	Spare Parts	9.9	0.1	8.2	0.3
D	Hardware Maintenance Overall	10.0	0.0	8.4	0.2

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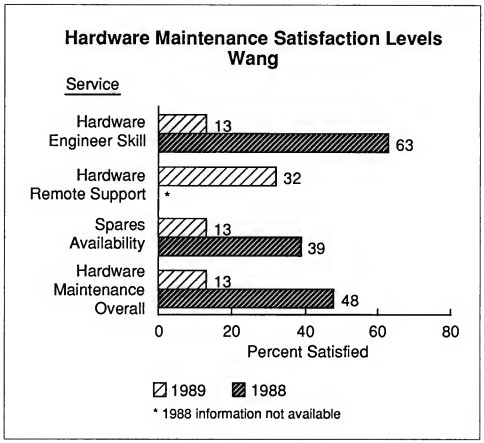
EXHIBIT IV-106



Seventy-three percent of the respondents reported receiving software support from Wang. Exhibit IV-107 presents the software support requirements reported by the Wang sample and the mean ratings of services received. Mean requirements reported ranged from 9.9 to 10.0 for the sample, while mean received ratings ranged from 7.2 to 7.8.

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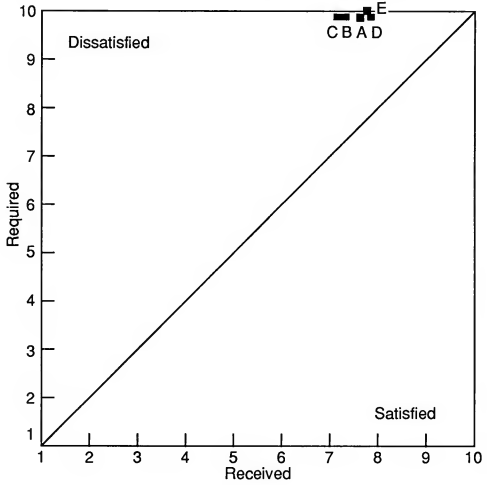
EXHIBIT IV-107

Software Support
Required versus Received
Wang



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	9.9	0.1	7.6	0.3
B	Software Remote Support	9.9	0.1	7.3	0.4
C	Software Documentation	9.9	0.1	7.2	0.4
D	Operational Training	9.9	0.1	7.8	0.3
E	Software Support Overall	10.0	0.0	7.7	0.2

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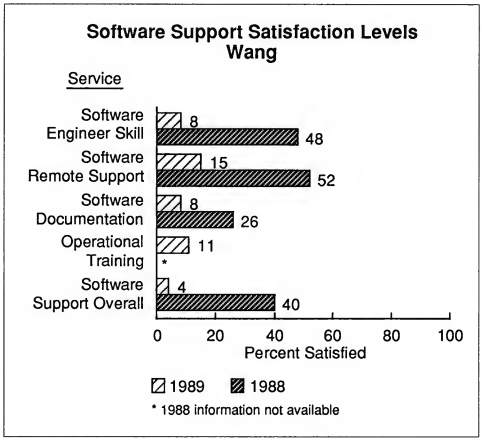
Software support satisfaction levels for the sample are presented in Exhibit IV-108. Fifteen percent of the sample reported receiving satisfactory software remote support, compared to 52% in 1988. Only four percent of the Wang users reported receiving satisfactory software support overall. Software support is clearly a problem area.

EXHIBIT IV-108



Exhibits IV-109 and IV-110 present an analysis of ancillary service requirements versus service received and satisfaction levels with ancillary services. Mean ratings for ancillary requirements ranged from 6.1 for maintenance training to 9.8 for ancillary services overall. Satisfaction levels ranged from 3% of the users being satisfied with the overall ancillary services received, to 38% being satisfied with the consulting services received from Wang.

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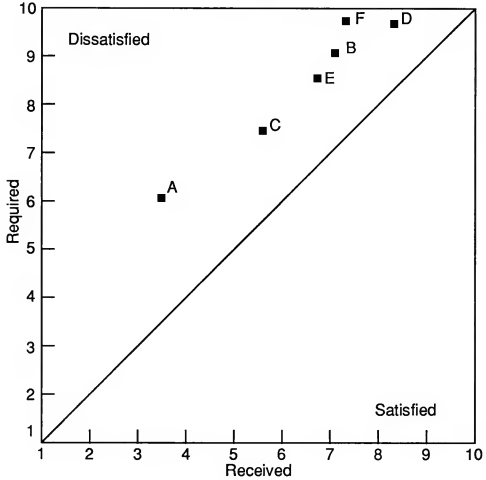
EXHIBIT IV-109

Ancillary Services
Required versus Received
Wang



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	6.1	.6	3.5	.5
B	Preinstallation Planning	9.1	.4	7.1	.4
C	Consulting	7.5	.7	5.5	.6
D	Installation/Deinstallation	9.7	.2	8.3	.3
E	Network Design/Planning	8.5	.6	6.8	.6
F	Ancillary Services Overall	9.8	.1	7.3	.2

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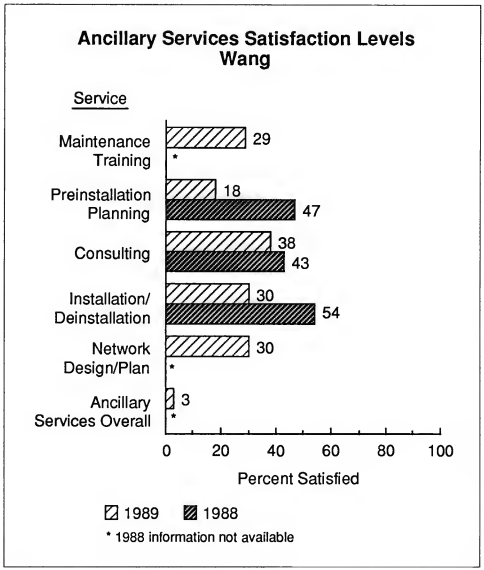
EXHIBIT IV-110



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Midrange Systems Summary Data

Midrange Systems Summary Data

In this chapter, INPUT presents selected data from the 1989 midrange systems users requirements analysis. These summary charts allow a vendor-by-vendor comparison of service performance. Data is only presented on items that can be compared on an absolute basis, not on subjective (ratings) data. The key to any analysis of customer satisfaction is the ability of the vendor to satisfy the customer's specific requirements, rather than the attainment of any high "rating" of performance. Even the highest "rating" will still be lacking if the individual user's requirements exceed the rating.

Exhibit V-1 presents vendor performance in terms of system interruptions and causes for system interruptions. Exhibit V-2 depicts system availability requirements versus availability received; Exhibit V-3 shows response time and Exhibit V-4 presents repair time required versus received. In Exhibits V-2 through V-4, the difference between the mean required and the mean received are presented to illustrate how closely the vendor meets the users' requirements. Exhibits V-5 through V-7 give the satisfactions levels by vendor for system availability, response time, and repair time. Exhibit V-8 shows overall hardware maintenance satisfaction by vendor. Exhibit V-9 presents the overall software support satisfaction levels of the users, and Exhibit V-10 presents the overall satisfaction levels of the users for ancillary services received from their midrange system vendor.

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EXHIBIT V-1

Midrange System Vendor Performance
System Interruptions

Vendor	Mean Number Per Month	Percent Caused By:			
		Hardware	System Software	Application Software	Other
AT&T	0.5	66	16	10	8
Concurrent	1.0	75	12	5	8
Data General	0.5	54	9	4	33
DEC	0.5	58	9	13	20
HP	0.5	58	15	1	26
IBM 937X	0.7	57	22	3	18
IBM AS/400	0.6	68	18	2	12
Prime	0.9	66	13	3	18
Tandem	0.4	63	5	1	31
Wang	0.5	65	9	3	23
All Vendors	0.6	63	13	4	20

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EXHIBIT V-2

Midrange System Vendor Performance System Availability

Vendor	System Availability (Percent)		Difference
	Required	Received	
AT&T	96.4	95.9	(0.5)
Concurrent	97.6	97.8	0.2
Data General	96.9	96.7	(0.2)
DEC	98.0	97.1	(0.9)
HP	96.3	96.9	0.6
IBM 937X	97.3	97.5	0.2
IBM AS/400	95.9	98.0	2.1
Prime	97.1	97.4	0.3
Tandem	99.8	99.0	(0.8)
Wang	98.7	98.7	-
All Vendors	97.5	97.4	(0.1)

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EXHIBIT V-3

Midrange System Vendor Performance Response Time

Vendor	Response Time (Hours)		Difference
	Required	Received	
AT&T	9.4	11.3	(1.9)
Concurrent	5.8	5.3	0.5
Data General	7.6	7.1	0.5
DEC	2.9	2.1	0.8
HP	5.9	4.1	1.8
IBM 937X	2.2	1.7	0.5
IBM AS/400	1.7	1.6	0.1
Prime	3.2	2.2	1.0
Tandem	2.6	1.6	1.0
Wang	2.9	1.9	(1.0)
All Vendors	4.5	3.9	0.6

Note: Negative difference denotes requirements not being met.

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EXHIBIT V-4

Midrange System Vendor Performance Repair Time

Vendor	Repair Time (Hours)		Difference
	Required	Received	
AT&T	9.1	9.0	0.1
Concurrent	7.1	8.4	(1.3)
Data General	5.4	4.1	1.3
DEC	4.9	3.6	0.7
HP	3.6	1.9	1.7
IBM 937X	2.7	2.9	(0.2)
IBM AS/400	2.9	2.7	0.2
Prime	2.8	2.9	(0.1)
Tandem	3.7	2.8	0.9
Wang	2.9	1.6	1.3
All Vendors	4.7	4.0	0.7

Note: Negative difference denotes requirements not being met.

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EXHIBIT V-5

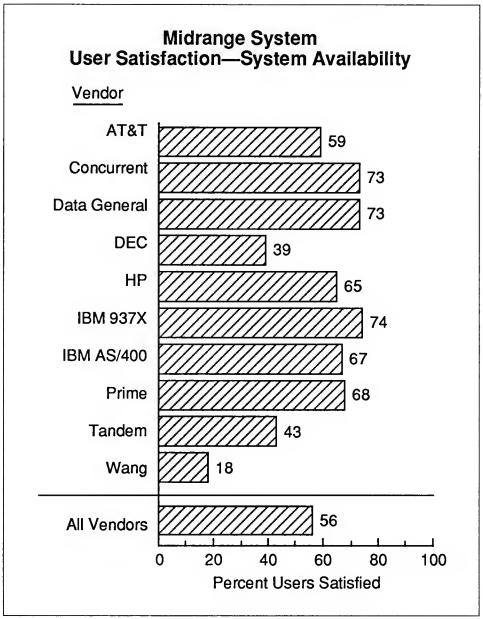

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EXHIBIT V-6

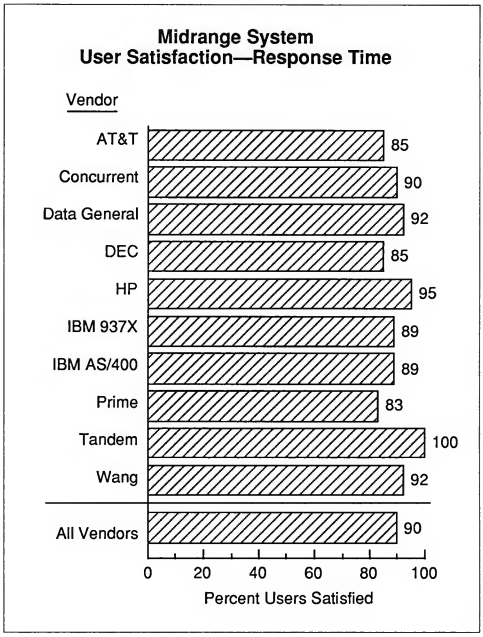

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EXHIBIT V-7

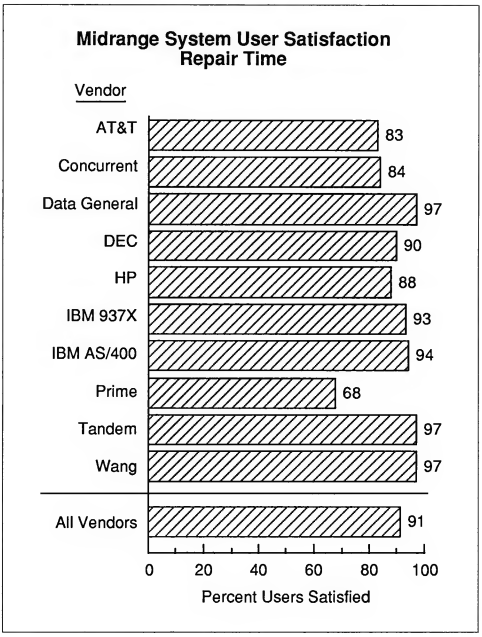

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EXHIBIT V-8

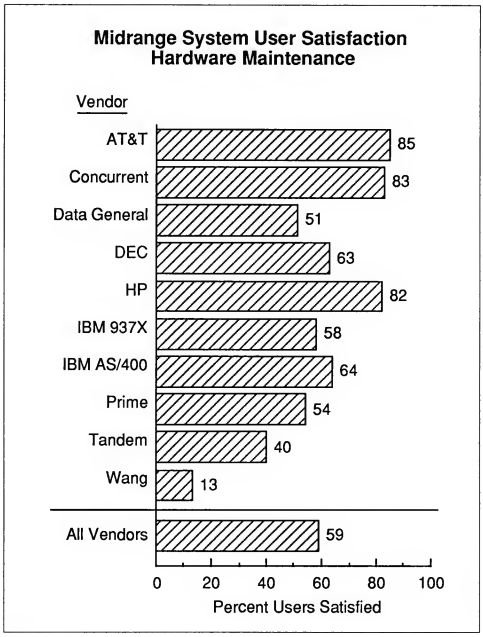

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EXHIBIT V-9

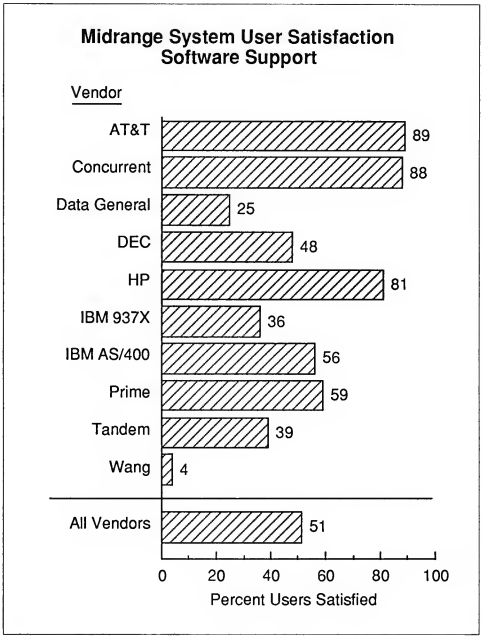

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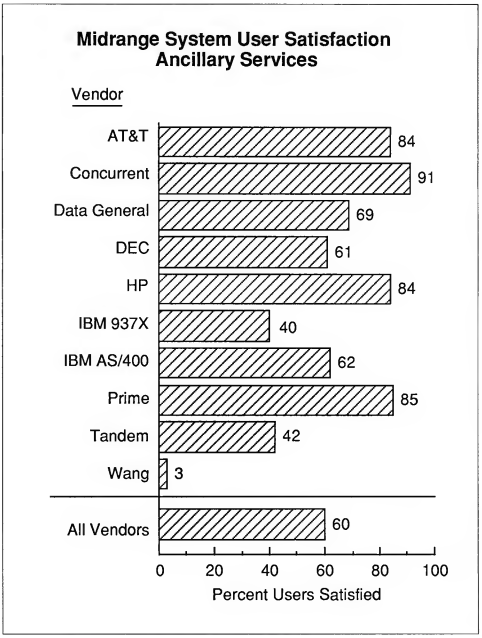
EXHIBIT V-10



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Appendix: Questionnaire

Appendix: Questionnaire

As listed on "call sheets," confirm with respondent:

1. CPU manufacturer _____

2. Model _____

We'd like to focus our questions on your (manufacturer/model as listed) system. Is that system still in use there? (If no, terminate interview.)

Please keep the service you receive for this system's CPU in mind throughout the survey.

First, some background information:

3. Who provides maintenance service for this CPU? (read list; check one):
   a. The manufacturer ❑
   b. A third-party maintainer ❑

   If third-party maintenance ("TPM"):
   Please specify TPM company: _____
   If third-party, thank respondent and terminate interview here.

4. Regarding the maintenance coverage on this CPU:
   a. Does your contract cover service (read list; check one):
      1) 5 days a week ❑
      2) 7 days a week ❑
      3) Other? (please specify) _____

   b. 1) 8 hours per day ❑
      2) 16 hours per day ❑
      3) 24 hours per day ❑
      4) Other? (please specify) ❑

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Now we'd like to ask a few questions about how you chose your service vendor.

5. I have a list here of different aspects of the service decision. As I read through them, would you please rate the importance of each criterion in the selection of your service vendor?
On a scale of one to ten (ten being highest), what was the importance of (read list):

Factor	Importance (1-10)
a. Price	_____
b. Service quality	_____
c. System availability	_____
d. Response time on a service call	_____
e. Access to spare parts	_____
f. Technical expertise	_____
g. Software support	_____
h. Contract flexibility	_____
i. Ability to service other vendors' products	_____
j. Vendor reputation	_____

Now, some questions about your basic support requirements.

6. Over the past twelve months, how many system interruptions (system failures) did you average per month? _____/month

7. What percent of these interruptions were caused by:

	percent
a. Hardware failure	_____
b. System software	_____
c. Application software	_____
d. Other	_____

(i.e., user error, environmental disruption, etc.) note: total should equal 100%

8. a. What percent system availability ("uptime") do you require? _____
b. What percent system availability do you actually receive? _____

9. Response time being defined as the time it takes a field engineer to arrive at your site after you place a trouble call:
a. What response time do you require? _____ hours
b. What is the average response you receive? _____ hours

10. Repair time being defined as the amount of time it takes on average to have your system up and running after the field engineer arrives:
a. What repair time do you require? _____ hours
b. What repair time do you receive on average? _____ hours

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11. For the following list of hardware maintenance services, can I have you rate (again on a scale of one to ten):
First, the level of service you require; then the level of service you're actually receiving in each area.
Let's start with (read list):

	1. Required (1-10)	2. Received
a. Hardware engineer skill level	_____	_____
b. Hardware remote support	_____	_____
c. Spare parts availability	_____	_____
d. Hardware maintenance overall	_____	_____

12. Do you receive software support from your CPU manufacturer as well? (check one)
Yes _____ (If yes, proceed to question 13.)
No _____ (If no, skip to question 15.)

13. For this software support, please rate your requirements and what you've received in terms of (read list):

	1. Required (1-10)	2. Received
a. Software engineer skill level	_____	_____
b. Software remote support	_____	_____
c. Software documentation	_____	_____
d. Operational training	_____	_____
e. Software support overall	_____	_____

14. Defining a "major" software problem as one in which all processing is prevented, while a "minor" problem allows continued processing with some degradation, over the past twelve months:

a. How many major software problems were reported, on average, per month?
_____ /month
b. How many minor software problems were reported on average, per month?
_____ /month
c. What was the average turnaround, in hours (based on 24-hour day), for major problem resolution? _____ hours
d. What was the average turnaround, in hours (based on 24-hour day), for minor problem resolution? _____ hours

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Now, if we can ask a couple questions about support beyond normal maintenance (or ancillary) services:

15. For the following ancillary support services, could you please rate (1-10) your requirement for each service, and then the level of service you're currently receiving?

	1. Required (1-10)	2. Received
a. Maintenance-related training	_____	_____
b. Preinstallation planning services (i.e., environmental, site and installation planning)	_____	_____
c. Consulting	_____	_____
d. Installations/deinstallations/ moves	_____	_____
e. Network design/planning	_____	_____
f. Ancillary services overall	_____	_____

16. Do you currently receive any of the following multivendor services from your service vendor (check all that apply):

a. Service on other manufacturers' systems (CPUs)	_____
b. Service on other manufacturers' peripherals	_____
c. Service on other manufacturers' network products	_____

17. Do you currently receive any of the following discounts, and if so, can you tell me what percent discount you receive? (read list)

	1. Receive (Y/N)	2. Percent discount
a. Multiyear	_____	_____
b. Prepayment	_____	_____
c. Call screening/problem management	_____	_____
d. Deferred response	_____	_____

If yes to all (a. through d.) above, proceed to question 19.

18. Regarding those discounts I mentioned that are you not currently receiving: First, on a scale of 1 to 10, how attracted are you to each of these other discount options; and, what percentage discount you would expect for each discount type?
(read only those discounts that respondent said they were not receiving in question 17 above).

a. Multiyear	_____	_____
b. Prepayment	_____	_____
c. Call screening/problem management	_____	_____
d. Deferred response	_____	_____

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Finally, we'd like to ask you about your attitudes toward "third-party maintenance," (TPM) (or maintenance done by a specialized service company other than the manufacturer of the equipment).

19. Have you been contacted by a TPM in the last twelve months? (check one)
    Yes _____
    No _____
    If yes, proceed to question 20; if no, skip to 21.

20. Can I ask which TPMs have contacted you, and very briefly, why you didn't opt to switch to their service?

1. TPM company name	2. Reason
a.	
b.	
c.	

21. At what percentage discount would you be willing to switch to third-party maintenance, if at all? (check one):
    a. 1-10%
    b. 11-20%
    c. 21-30%
    d. 31-40%
    e. 41-50%
    f. 50+%
    g. Unwilling at any discount

That about covers it! Thanks for your patience.

22. To wrap this up, can I ask what you would consider to be your singular most pressing service concern at this time?

23. And, if you could choose one additional service that your vendor is not currently providing, what would that be?

Thanks very much for your time. You've been a great help! To make sure you receive your complimentary report summary, let me check the spelling of your name and the address information (confirm and record on cover sheet).

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Appendix: Definitions

Appendix: Definitions

Applications Software - Software that performs processing to service user functions.

Ancillary Services - A catagory of services that typically complement hardware maintenance and software support. Examples are installation/ deinstallation, preinstallation planning, network management and network design and management.

Artificial Intelligence - The academic discipline involving the study of the processes by which humans perceive and assimilate data (and use reasoning to process this data) for the purpose of duplicating these processes within computer systems. Also, this term refers to the computer systems that accomplish these duplicated processes.

BOC - Bell Operating Company.

Consulting - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.

Dispatching - The process of allocating service resources to solve a support-related problem.

Divestiture - The action, stemming from antitrust lawsuits by the Department of Justice, which led to the breakup of AT&T and its previously owned local operating companies.

Documentation - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.

End User - May buy a system from the hardware supplier(s) and do own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.

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Expert Systems Applications - Applications for expert systems—a computer system based on a data base created by human authorities on a particular subject. The computer system supporting this data base contains software that permits inferences based on inquiries against the information contained in the data base. Expert systems is often used synonymously with "knowledge-based systems," although this latter term is considered to be broader and to include expert systems within its scope.

Engineering Change Notice (ECN) - Product changes to improve the product after it has been released to production.

Engineering Change Order (ECO) - The follow-up to ECNs that include parts and a bill of material to effect the change in hardware.

Escalation - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.

Fiber Optics - A transmission medium which uses light waves.

Field Engineer (FE) - For the purpose of this study, field engineer, customer engineer, service person, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

Field Service Management System (FSMS) - A specialized application program that automates some (if not all) of the following activities of a field service organization: call handling, dispatching, parts inventory and tracking, billing, efficiency reporting, and other functions. Ideally, the system accesses one data base from which each function can use and modify data.

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.

ISDN - Integrated Services Digital Network. A proposed standard for digital networks providing transport of voice, data, and image using a standard interface and twisted pair wiring.

LADT - Local Area Data Transport. Data communications provided by the BOCs within local access transport areas (LATA).

Large System - Refers to traditional mainframes including at the low end IBM 4300-like machines and at the high end IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of $350,000 and higher.

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Mean Time Between Failures (MTBF) - The elapsed time between hardware failures on a device or a system.

Mean Time to Repair - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.

Mean Time to Respond - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.

Microcomputer - A microprocessor-based single- or multi-user computer system typically priced less than $15,000. A typical configuration includes an 8- or 16-bit CPU, monitor, keyboard, two floppy disk drives, and all required cards and cables.

Minicomputer - See Small System.

Operating System Software (Systems Software) - Software that enables the computer system to perform basic functions. Systems Software, for the purposes of this report, does not include utilities or program development tools.

PBX - Private Branch Exchange. A customer premises telephone switch.

Peripherals - Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.

Planning - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.

Plug-Compatible Mainframe (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.

Professional Services - A category of services including system design, custom programming, consulting, education, and facilities management.

RBOC - Regional Bell Operating Company. One of seven holding companies coordinating the activities of the BOCs.

Remote Diagnostics - Gaining access to a computer from a point physically distant from the computer in order to perform problem determination activities.

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Remote Support Implementation - An extension of remote diagnostics where some level of support delivery is performed from a point physically distant from the computer. Currently, this capability is more common to software support where problems can be solved or circumvented through downline loading of new code (fixes).

Reseller - A marketing organization which buys long-distance capacity for others at wholesale rates, selling services at retail but discounted prices and profiting on the difference.

Small Business Computer - For the purpose of this study, a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented systems software support.

Small System - Refers to traditional minicomputer and superminicomputer systems ranging from a small multi-user, 16-bit system at the low end to sophisticated 32-bit machine at the high end.

Software-Defined Network - A private network which uses public network facilities and which is configurable on an as-needed basis by the user (see Virtual Private Network).

Software Engineer (SE) - The individual who responds (either on-site or via remote support) to a user's service call to repair or patch operating systems and/or applications software.

Software Products - Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

Superminicomputer - See Small System.

Systems Integration - The action of a single service vendor's design, development, and implementation of a system or subsystem including integration of hardware, software, and communications facilities for a customer.

System Interruption - Any system downtime requiring an Initial Program Load (IPL).

Systems House - Integrates hardware and software into a total turnkey system to satisfy the data processing requirement of the end user. May also develop systems software products for license to end users.

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T-1 - Refers to a standard I.544 megabit per second digital channel used between telephone company central offices and now used for microwave, satellite, fiber optics, or other bypass applications.

Third-Party Maintenance (TPM) - Any service provider other than the original equipment vendor.

Training - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.

Turnkey System - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

VSAT - Very Small Aperture Terminal. A small satellite dish system, usually using Ku-band frequencies.

Virtual Private Network - A portion of a public network dedicated to a single user.

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